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A REVALUATION OF THE WHOLE-PART PROBLEM IN LEARNING

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WHAT is the scientific answer to the question: Should a pupil memorize by the whole method or by the part method?

Since the initial experimental attack upon this problem by Steffens in 1900,[1] a considerable body of experimental data has accumulated—the results of some thirty odd investigations. The problem is recognized as one of far reaching pedagogical importance as well as one of theoretical significance. It is, therefore, important to inquire what conclusions are justified by these widely different experimental attacks, and whether or not contemporary textbook treatments of the problem are in accord with the facts.

It should be stated here that the discussion in this paper will not cover acts of skill but will be limited to the field of memorizing, since the primary interest of the educator is in meaningful materials. The main contentions and conclusions of this paper, however, are equally true in the field of motor learning.

An analysis of seven well-known and widely used texts in educational psychology, which have been published within the last five years, gave the following results: In one text,[2] the problem is not discussed; in another,[3] the author concluded that "of the eleven or twelve reported experiments, about four favor the part method, and the rest, the whole method," but, because of the inconsistency of results, advised that each individual "find out as soon as possible by the experimental method what is the most efficient method for him;" in the remaining five texts it is

[1] Steffens, L. "Experimentelle Beiträge zur Lehre vom ökonomischen Lernen," *Zeitschrift für Psychologie*, 1900, XXII, 321-382.

[2] Trow, W. C. *Educational Psychology.* New York: Houghton Mifflin Co., 1931.

[3] Jordan, A. M. *Educational Psychology.* (New York: Henry Holt and Co., 1928), p. 175.

explicity stated, as the following quotations indicate, that the whole method is superior to the part in both learning and retention:

"Experiments show that—the 'whole' method, is more economical than 'learning by parts,' although part learning is the method more commonly employed in school."[4]

"The general answer from experimental work on this problem is that the whole method is better than the part method, other things being equal."[5]

"Poetry or prose can, as a rule, be memorized more quickly if the material is read through as a whole from beginning to end than if it is memorized in small sections of two or three lines; and what is more important, when this method is employed, the retention is more permanent."[6]

"The whole method shows to advantage in memorizing poetry, prose, vocabularies, lists of words and nonsense syllables—and probably in most materials which are to be memorized in serial order."[7]

"....the experimental evidence shows clearly that for the majority of individuals the method of learning by wholes is much superior."[8]

"....things which are to be learned in serial order are best learned by wholes, provided, of course, that the wholes are not unreasonably great. And when learned by wholes they are remembered for a longer time than if they had been learned by parts."[9]

These five authors, moreover, have no difficulty in presenting reasons for, and explanations of, the superiority of the whole method.

This tendency to accept a superiority of the whole method is here called in question. In a recent critical review of the experimental literature,[10] the investigations have been classified on the basis of types of learning materials used. In the twenty-two experiments on memorizing, the following, which varied in length, nature and difficulty, were used as learning materials: poetry, prose, paired associates or vocabularies and

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[4] Sandiford, P. *Educational Psychology.* (New York: Longmans Green and Co., 1929), p. 225.

[5] Pintner, R. *Educational Psychology: An Introductory Text.* (New York: Henry Holt and Co., 1929), p. 237.

[6] Starch, D. *Educational Psychology.* (revised edition) (New York: Macmillan Company, 1927), p. 201.

[7] Gates, A. I. *Psychology for Students of Education.* (revised edition) (New York: Macmillan Company, 1930), p. 334.

[8] Cameron, E. H. *Educational Psychology.* (New York: Century Company, 1927), p. 258.

[9] Sandiford, P. *op. cit.* p. 227.

[10] McGeoch, G. O. "Whole-Part Problem," *Psychological Bulletin,* XXVIII, (1931), 713-739.

lists of nonsense syllables and of words. Furthermore, the investigations varied widely in experimental conditions and techniques employed: in number, age, training and ability of subjects; in amount, distribution and nature of practice periods; in methods of measuring learning and retention efficiency; in length of interval after which retention was tested; and in the forms of the part method used. In only five of these twenty-two investigations, did the number of subjects used and the precision of experimental technique yield results amenable to statistical treatment. The results of these experiments are as follows:

Warner Brown[11] found the whole method reliably superior to the part in three out of his four groups of adult subjects who learned lists of 12 English-nonsense syllable pairs.

A progressive part method was found by Winch[12] to be superior to the whole with children from 11½ to 13 years old in the learning of "short" poems, but there was no reliable difference between the two methods in the retention of some of these poems.

H. B. Reed[13] found no reliable differences between the average scores for the whole, progressive part and part methods in the learning of four stanzas by adult subjects, and concluded that the efficiency of learning methods is a function of the individual learners, 77 percent of whom found a part method more economical.

Georgiana Wylie[14] found the whole method superior to the part with serial learning of lists of from 8 to 24 items with the majority of her adult subjects. This advantage of the whole increased with practice. There were no decisive differences, however, between the two methods in retention after an interval of 24 hours.

The writer[15] found no reliable differences between the whole, progressive part and pure part methods with 9 and 10 year old children in the learning or retention of 12 lines of poetry. With the same subjects, however, she found a reliable superiority of the whole method over the pure part in the learning and retention of vocabulary material,

[11] Brown, Warner. "Whole and Part Methods in Learning," *Journal of Educational Psychology*, XV, (1924), 229-233.

[12] Winch, W. H. "Should Poems be Learnt by School Children as 'Wholes' or in 'Parts'?" *British Journal of Psychology*, XV (1924), 64-79.

[13] Reed, H. B. "Part and Whole Methods of Learning," *Journal of Educational Psychology*, XV (1924), 107-115.

[14] Wylie, Georgiana E. "Whole versus Part Methods of Learning as Dependent upon Practice," Doctoral Dissertation, 1928, on file in the library of the University of Chicago.

[15] McGeoch, G. O. "The Intelligence Quotient as a Factor in the Whole-Part Problem," *Journal of Experimental Psychology*, XIV (1931), 333-358.

lists of 10 Turkish-English pairs and lists of 10 nonsense syllable—English pairs. In learning, this advantage of the whole method was relatively as well as absolutely greater with the gifted group (mean I.Q. 151) than with the normal group (mean I.Q. 99). There were, however, no consistent differences between the whole and progressive part or between the progressive part and pure part methods.

In a recent investigation the writer found no reliable differences between the whole and pure part methods in the learning or retention of 12 lines of poetry by third and fourth grade school children, and in another experiment with children of the same age who learned 24 lines of poetry, no reliable difference between the two spontaneous and habitual methods, learning "by lines" and learning "by verses."

On the basis of such a variety of results, *all of which are statistically reliable*, which method, can we conclude, is superior? Should we interpret this disagreement as an indication of defects in the experimental technique of those investigators who failed to establish the superiority of the whole method? Such questions imply that there is a method of learning which is *really* or *inherently* superior, and that certain experimental conditions permit this superiority to show itself, while other conditions mask or hide this intrinsic superiority. McGeoch[16] has called attention to the fact that such a point of view is contrary to the logic of science. No phenomenon known to science is unconditioned: an absolutely best method of learning has no empirical existence. The scientific goal, and likewise the goal of the educator, is to discover by experimentation all the possible factors of which the efficiency of any given learning method is a function. The question is not: Is the whole method superior to the part method? The question is: Under what conditions is the whole method superior to the part method?

The writer's[17] analysis of the experimental data has suggested that the relative efficiency of the whole and part methods is a function of, at least, the following factors:

I. Forms of the part method used: whether pure part, progressive part, irregular part, etc.

II. Methods of measuring learning efficiency: whether work limit or time limit criterion, whether forward or reverse association is

[16] McGeoch, J. A. "The Acquisition of Skill," *Psychological Bulletin*, XXVIII (1931), p. 418.

[17] McGeoch, G. O. "Whole-Part Problem," *Psychological Bulletin*, XXVIII (1931), 713-739.

tested with paired associates, whether poetry is scored on the basis of correct words, lines or thought, etc.

III. Subjects: their age, memorizing ability, practice in the use of the learning methods used and their intelligence.

IV. Material: type, difficulty, nature and length.

V. Practice: whether massed or distributed practice, total amount of practice and nature of practice periods.

VI. Methods of measuring retention efficiency: whether in terms of recall score, saving score, or a composite, learning-plus-relearning, score.

VII. Length of the interval after which retention is tested.

At the present time, however, the experimental data do not justify any generalization regarding the differential and reciprocal effects of these factors, while the specific effect of only two factors, practice and intelligence, have been demonstrated by Wylie[18] and the writer,[19] respectively, within the narrow limits of their experimental conditions.

Practically speaking, the present scientific data do not justify the recommendation of any particular learning method for classroom use. There is no scientific answer to the question: should a pupil memorize by the whole method or by the part?

[18] Wylie, Georgiana E. *op. cit.*

[19] McGeoch, G. O. "The Intelligence Quotient as a Factor in the Whole-Part Problem," *Journal of Experimental Psychology*, XIV (1931), 333-358.

LONG DIVISION VERSUS SHORT DIVISION

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To what extent do pupils use short division in examples with single-digit divisors? What are some of the factors which influence the selection of the method used? Which method is selected by brighter pupils? Is long division used with greater accuracy than short division?

The customary order of procedure in teaching division of numbers to elementary school pupils is to teach a child first to know a specific number of simple division combinations; secondly, to work examples with single-digit divisors and with varying numbers of digits in the dividend by a short division method; and, thirdly, to divide numbers containing divisors with two or more digits by a long division process. In short division the pupil mentally carries out the steps in the process, writing only the answer; in long division the child places each step of his calculations on paper.

Several writers have contended, and some evidence has been produced to prove,[1] that long division should precede short division and that the latter should be taught as a short-cut to the former. The evidence and arguments center largely in the problem of the order of introducing the two processes. Few individuals seem to have considered the question whether we should continue our present insistence on pupils' using the short division method with single-digit divisors. If we knew to what extent pupils throughout the different grades regularly use the short method under the condition prescribed and also the comparative accuracy with which the short and long processes are employed, we might even see reasons for contending that our present stress on short division is not worthwhile. By thus abandoning our insistence on short division, we could eliminate a field of considerable worry for the elementary school teacher. With the purpose in mind, therefore, of determining the extent to which and also the accuracy with which pupils throughout the grades use the short division method with single-digit divisors, the present study was undertaken.

[1] See especially Lenore John "The Effect of Using the Long-Division Form in Teaching Division by One-Digit Numbers" in *The Elementary School Journal* for May, 1930, pp. 675-692; and also R. L. Morton, *Teaching Arithmetic in the Primary Grades*. Silver, Burdett and Company, pp. 167-169.

The subjects engaging in this investigation consisted of 1265 pupils from grades IV to XII inclusive from four different school systems. Of these, 1083 were in the elementary grades from grades IV through VIII; the remaining 182 were in the high-school grades from IX through XII.

The pupils in all grades were given the same division test containing seven difficult examples, five of which had one-digit divisors and two of them two-digit divisors. Two forms of this test were constructed. In one, the two examples containing two-digit divisors appeared as the first and fourth among the seven examples in the test; in the other form, they appeared as the second and fourth. The reason for this variation in the order was to take into account the effect of a possible "mind-set," either for long or short division produced by the particular one of the two types which was placed first in the test. As it happened, the results showed no tendency that could be attributed to the order of appearance of the two types of examples in the test. No mention of short or long division was made to the pupils during the administration of this test. Thus, a measure of the pupils' tendency to use either long or short division in the case of single-digit divisors was obtained.

Besides this test, another was administered consisting of ten division examples with single-digit divisors. Five of the examples the pupils were requested to work by short division, the other five by long division. Two forms of this test were made. In the one form the pupils were asked to work the first five examples by the short division process and the second five by long division; in the second form these directions were reversed. Thus each group of examples was worked both by long and short division. Part of the pupils took the one form of the test; part took the other. By means of this arrangement, the pupils' scores attained by use of the two methods were comparable. The purpose of this test was to seek a measure of the comparative accuracy with which pupils work single-digit examples by short and long division.

The teachers of the children in the investigation administered the tests by following carefully worded instructions. The teachers were told that the tests were not designed with a view to comparing the achievements of the pupils involved but merely with the purpose of getting data on the comparative effectiveness with which pupils work by the long and short division methods.

Table I presents the numbers and percentages of pupils who worked the five division examples containing one-digit divisors by long division exclusively, those using short division exclusively, and those who worked

some examples by the long and some by the short process. It will be noted that in grade IV there were 147 pupils who worked by the long method, 33 who worked by the short method, and four who used both methods. Interpreted in percentages, 80 percent of the pupils in grade IV worked by long division, 18 percent by short division, and two percent partly by one and partly by the other method. Similar data are given for the remaining grades. The figures for all grades combined show that three out of four pupils use the long division method with examples containing one-digit divisors, one out of five use short division, while one out of twenty use both methods. Little difference between the elementary and high-school grades is to be noted. Short division had been stressed in grade III which fact would lead one to anticipate a larger percentage of use of this method in grade IV. No such observation is to be made, however. Grades V and IX show marked variation but the significance of these variations is minimized by the fact that they can be accounted for by no reason other than that such a large percentage of the pupils comprising these two grades happened to be located in grade rooms in which apparently unusual efforts had been made by the teachers in requiring the pupils to work all examples with single-digit divisors by the short method. Further comments upon this point will be made in a later paragraph of this article.

Not only was it of interest to know what percentages of pupils elected to work examples with single-digit divisors by the long division method but also to determine the accuracy with which pupils use each of the two

TABLE I

NUMBER AND PERCENTAGE OF PUPILS WORKING SHORT DIVISION EXAMPLES BY LONG DIVISION EXCLUSIVELY, BY SHORT DIVISION EXCLUSIVELY, AND PART OF THE EXAMPLES BY ONE AND PART BY THE OTHER METHOD

Grade	Long Division		Short Division		Both Methods		Total No. of Pupils
	Number	Percent	Number	Percent	Number	Percent	
4	147	80	33	18	4	2	184
5	139	60	87	38	4	2	230
6	188	86	22	10	10	4	220
7	209	78	42	16	17	6	268
8	141	78	27	15	13	7	181
9	35	64	17	31	3	5	55
10	48	79	9	15	4	6	61
11	23	70	8	24	2	6	33
12	24	73	6	18	3	9	33
Elem.	824	76	211	20	48	4	1083
H. S.	130	71	40	22	12	7	182
Total	954	75	251	20	60	5	1265

methods. This information is presented in Table II. As noted at the outset of this discussion, the pupils were requested first to work five ex-

amples by one method and then five additional examples by the other method, method and sets of examples being rotated to eliminate the variables which otherwise would have been present. According to Table II, in grade IV there were 581 examples correct by long division or 63 percent of the examples attempted by 184 pupils, whereas when short division was employed, 520 examples were correct or 57 percent of all attempted. In the total figures both for the elementary and high-school grades long division shows the greater accuracy. The totals for all grades indicate 80 percent accuracy for long division and a corresponding 75 percent for short division. The facts appear to show not only that pupils prefer to work one-digit examples by long division but that they use this process with single-digit numbers with greater accuracy.

That the preponderant preference for long division characterizes the good student as well as the average and poor one is borne out by the data in Table III. In this table appear the numbers and percentages of pupils using long division, short division, or both methods among those who got all of their examples correct. As in Table II, this table reveals that the ratio of long to short division is almost 3 to 1. Though the use of a combination of both methods among the good students parallels very closely that observed in Table II for all students, there is a noticeably greater preference for short division among the good students inasmuch

TABLE II

COMPARATIVE ACCURACY WITH WHICH PUPILS WORKED LONG DIVISION AND SHORT DIVISION EXAMPLES WHEN THEY WERE REQUESTED TO USE FIRST THE ONE METHOD AND THEN THE OTHER

Grades	4	5	6	7	8	9	10	11	12	4-8	9-12	4-12
Pupils	184	230	220	268	181	55	61	33	33	1083	182	1265
Examples Correct by:												
Long Division	581	860	904	1096	834	239	270	149	134	4275	792	5067
Short Division	520	817	816	1066	789	219	248	129	120	4002	717	4719
Percentage Score by:												
Long Division	63	75	82	82	92	87	89	90	81	79	87	80
Short Division	57	71	74	80	87	80	81	78	73	74	79	75

TABLE III

NUMBER AND PERCENTAGES OF PUPILS AMONG THOSE HAVING ALL EXAMPLES CORRECT WHO WORKED BY LONG DIVISION EXCLUSIVELY, BY SHORT DIVISION EXCLUSIVELY, AND THOSE WHO WORKED PART OF THE EXAMPLES BY ONE AND PART BY THE OTHER METHOD

Grades	4-8		9-12		4-12	
	Pupils	Percent	Pupils	Percent	Pupils	Percent
Long Division	277	70	46	64	323	69
Short Division	98	25	21	29	119	26
Both Methods	20	5	5	7	25	5
Total	395	100	72	100	467	100

as approximately 5 percent more of the good students used short division. This appears to hold true both for elementary and high school students.

The strongest factor associated with the use of short or long division appeared to be that of the teacher. In one school building the fourth-grade pupils worked the examples with single-digit divisors exclusively by long division, the fifth-grade used short division almost without exception, whereas the sixth-grade used long division. In one school system in school buildings closely adjacent, a fourth-grade employed short division almost entirely while another fourth-grade used long division. However, no consistent greater accuracy in such cases could be found favoring either method. In Table IV, below, appear the average scores per pupil, based on the five division examples with single-division divisors, of two fourth-grade rooms, in one of which short division predominated and in the other long division. In addition to this, the scores

TABLE IV

COMPARATIVE AVERAGE SCORES OF PUPILS IN ROOMS IN WHICH SHORT DIVISION WAS THE PREDOMINANT METHOD EMPLOYED AND IN ROOMS IN WHICH LONG DIVISION WAS THE PREDOMINANT METHOD EMPLOYED

	No. Students	Average Score
Fourth Grade:		
Room A(S)	33	2.8
Room B(L)	34	3.6
Fifth Grade:		
Rooms C and D(S)	76	3.9
Remaining Rooms (L)	154	3.1

(S) refers to rooms in which short division was predominant.
(L) refers to rooms in which long division was predominant.

of two groups of fifth-grade rooms are included, one composed of two rooms using mainly short division and one composed of the remaining fifth-grade rooms which employed mainly long division. It will be noted that though the pupils using long division in the fourth-grade had an advantage of almost one example out of five, a similar advantage favored the short division group in the fifth grade. These facts in all likelihood mean that a factor, which in this case outweighs the effect of the particular method used, is the efficiency of the teaching in the classrooms concerned. The pupils who were best taught achieved the higher scores regardless of the method used. Another explanation may be the varying capacities of the groups of children concerned.

CONCLUSIONS

The conclusions which may be drawn from the results of this investigation are as follows:

(1) Three out of four pupils from grades IV to XII, inclusive, chose to work difficult examples in division with single-digit divisors by long division; one out of five elected short division, whereas one out of twenty chose to work partly by long and partly by short division.

(2) Little difference in choice of method could be attributed to the grade in school to which a child belonged. High-school pupils varied little from those in the elementary school. Even pupils in the fourth grade, notwithstanding their recent intensive experience with short division in the third grade, predominantly used the long division method.

(3) A slightly stronger tendency toward short division on the part of good students both in the elementary and high-school grades was observed.

(4) Pupils used the long division method with greater accuracy. When they were requested to work examples containing single-digit divisors by short division and other examples by long division the average accuracy for long division was 80 percent and that for short division 75 percent.

(5) The greatest factor determining the choice of method seemed to be that of the teacher and teaching method. In two school systems short division was markedly more used than in two others. In the same school system one classroom of a given grade used long division almost exclusively while another classroom of the same grade used short division almost exclusively.

EDUCATIONAL IMPLICATIONS

Since three out of four pupils in school prefer long to short division in working difficult examples with single-digit divisors and, again, since pupils are more accurate with the long than the short form, it seems advisable that teachers should not only teach long division first but teach it as the regular method that will be used by the majority of the pupils. Short division can then be taught as a short-cut to be used particularly with comparatively easy examples. Especially the better pupils may be advised to employ the short method.

TYPES OF ERRORS AND REMEDIAL WORK IN THE FUNDAMENTAL PROCESSES OF ALGEBRA

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THIS investigation was conducted to supplement in an explicit and tangible manner the analyses of the specific errors which are most frequently made in the fundamental processes of algebra. The study was confined to the difficulties of the ninth grade. The data were collected from 104 ninth-grade pupils in the East High School, Superior, Wisconsin. With the exception of one boy, whose I. Q. was only 65, the intelligence quotients of these pupils ranged from 72 to 134. There were from 79 to 104 papers for each test, depending upon the daily attendance. Since this investigation was conducted in regular classes, all the usual difficulties and inadequacies of classroom investigations were encountered. The results are, therefore, only indicative of what could be discovered or produced by controlled experimentation. This report describes such activities as any classroom teacher can conduct.

These pupils were from five city ward schools, two parochial schools, and from outlying country schools, and ranged in age from twelve years to sixteen years. The results of the Otis Self-Administering Tests, Form A, were used as the basis of grouping. Due to conflicts in individual programs some shifting had to be done, and, as shown in Table I, the resulting groups were fairly heterogeneous. Later in the year, after the algebraic ability of individuals had been discovered, pupils were shifted, as far as their schedules would permit, into homogeneous groups.

TABLE I

CLASSIFICATION OF GROUPS

Group	Number of pupils in group	Average I. Q.	Range of I. Q.
A	26	115.2	100 to 134
B	28	108.3	85 to 126
C	22	93.9	91 to 114
D	28	87.7	65 to 102

During the first semester, one pupil failed because of lack of effort, one transferred to another school, and one dropped because of illness. Before the close of the second semester, six pupils, all of whom were from the D group, dropped out of school.

The errors of each pupil on the first test were noted, and only those pupils who attained less than 90 percent were given additional drill work on the type of performance missed and another test. This procedure was continued until the pupil reached the limit of his ability. There were pupils in these groups whose lack of ability prevented high-grade performance. A study was made of 179 problems in the four fundamental processes in the solution of which 1312 pupil errors were isolated. Simple timed tests were given on each principle involved, and the diagnosis of errors was made from these test papers. Each paper was studied to locate the characteristics of each pupil's errors.

Errors in addition.—A study of tests in the addition of algebraic quantities indicates that the most frequent errors occurred in the use of coefficients. Out of a total of 347 errors, 97, or 27.9 percent, were coefficient errors. These errors are so closely related to those made in arithmetical combinations that they properly may be analyzed together. Many of the errors in the addition of monomials and polynomials were due either to the carrying of one too many or to failing to carry in the arithmetical processes. These errors suggested that the sign and the arithmetical combinations were not sufficiently automatic to allow the pupil's entire attention to be centered on what was new in algebra. Thirty-three other errors in addition were due to confusion which may have resulted from the fact that the vertical columns in addition of polynomials were arranged illogically or were not placed directly under each other. Arranging quantities in proper columns with their correct signs, combining the positive and negative numbers as they occur, or adding the positive and then the negative numbers and combining the result by means of subtraction in order to get the correct result is a complex problem for beginners in algebra. An algebraic quantity without a coefficient of more than one was invariably counted as *0*. This error persisted after much drill.

Carelessness in writing was another source of trouble; careless writing of *10* caused it to be read as *16*, and *z* was read *2* and *a* was sometimes taken for *9*. The next largest number of errors appeared in the use of signs. These errors were due principally to the consistent policy of a few pupils to find the result and prefix the sign of the top number. In the process itself the greatest difficulty was with the minus sign. As used in arithmetic it suggested "take away," and so the pupils subtracted. Thirty of the process errors were due to this confusion. Twenty-two errors were made when the plus and minus signs occurred together,

in which case the sign of the top number was prefixed, and, as the problems were in addition, the sum was found. Errors were made in copying the problems from the board, especially in copying a polynomial which had to be arranged in a logical order as it was copied. For example, a distinction between a and a^2 was not always made. Another difficulty was in keeping the terms and the signs directly under each other.

Errors in subtraction.—Signs gave the greatest trouble in subtraction. There was evidence that some pupils thought the result should always be negative, probably because the problems were in subtraction. The method used in teaching this process was the addition method, "What should you add to the subtrahend to get the minuend?" Other troublesome combinations were $\begin{array}{r} -15 \\ -\ 8 \\ \hline \end{array}$ $\begin{array}{r} -15 \\ +\ 8 \\ \hline \end{array}$ and $\begin{array}{r} -9 \\ -12 \\ \hline \end{array}$; the results given were $+7$, $+23$, and $+21$. The word "add" in the directions probably accounts for this. In the removal of parentheses the greatest number of errors appeared in the failure to change the sign of the last term in the parentheses. Another difficulty was with the larger subtrahend like $\begin{array}{r} +18 \\ +20 \\ \hline \end{array}$ and $\begin{array}{r} -\ 9 \\ -12 \\ \hline \end{array}$ the results given being $+38$ and -21. It was evidently easy to perform the operations indicated by the signs in the removal of parentheses, but it was a puzzle to know when to add and when to subtract if the numbers were placed under each other with plus and minus signs. Since subtraction is little used except when parentheses occur, these errors were not considered seriously.

Errors in multiplication.—In the multiplication of algebraic quantities the problems become more complex for the child, and the analysis of the errors also becomes more complicated. In the problem $7x - 3(4x - 7)$, the prevailing error was in multiplying by $7x$ as well as by 3. Out of 66 errors 42 were due to this misunderstanding. Multiplying the first term only was next in prevalence, and removing the parenthesis and combining as in addition was another type of error. Signs gave trouble in the removal of parentheses. In the problem $-2a(3a + 4a - 6)$ the common error was the removal of the parentheses and a change of sign as if a minus sign preceded the parenthesis; no multiplication was performed. The problem evidently was understood as a subtraction problem.

In the multiplication of polynomials an interference seemed to arise from the law of signs. Since like signs in multiplication give a positive product, these problems being in multiplication, the like signs gave a

positive result when the partial products were added, and likewise the sum of the unlike signs gave a negative result. Inserting an extra term or omitting a term caused a few of the errors in multiplication. These occurred most frequently in the horizontal multiplications, as did also the coefficient errors. The question whether or not these were arithmetical or algebraical errors was frequently difficult to determine. As examples, $(2x + 1)(x + 2) = 2x^2 + 5x + 3$ and $(a + 6) = \begin{matrix}(6a^2 + 12a + 72)\\ (\quad a^2 + 6 \quad)\end{matrix}$ represent some typical results given. It is evident that *72* represents an arithmetical trouble and that *3* was the result of the wrong process, presumably because the plus sign before the *3* suggested addition. The errors made in the exponents occurred mostly in the addition of the partial products. It appears that the law of exponents learned for multiplication acted as an interference when the adding of the partial products was required. Since the problems involved were multiplication problems the exponents were added as follows when the partial products were combined:

$$\begin{array}{ll} 3x^2 + 4x - 3 & \\ 2x + 1 & \\ \hline 6x^3 + & 8x^2 - 6x \\ & 3x^2 + 4x - 3 \\ \hline 6x^3 + & 11x^4 - 2x^2 - 3 \end{array}$$

It was sometimes difficult also to determine whether the wrong coefficient was an arithmetical or an algebraic error. It might have been either the result of the combination of the wrong terms or a lack of facility with the number combinations.

Errors in division.—The analysis of the errors in division presented about as complicated a problem as did the analysis of those in multiplication. Since many of the fundamental processes were involved here, errors already analyzed in the preceding pages were found in the division of monomials and polynomials.

TABLE II

DISTRIBUTION OF ERRORS AMONG THE FOUR FUNDAMENTAL PROCESSES

Process	Number of Problems	Percent of Problems	Number of Errors	Percent of Errors
Addition	3038	42.3	347	26.5
Subtraction	1756	24.4	225	17.1
Multiplication	1614	22.4	519	39.6
Division	789	10.9	221	16.8
Total	7197	100.0	1312	100.0

Distribution of errors.—Tables II to VI show the distribution of the errors among the four fundamental processes, among the different types of errors, and among the four ability groups.

TABLE III

DISTRIBUTION OF THE ERRORS MADE IN THE FOUR FUNDAMENTAL PROCESSES AMONG THE FOUR DIFFERENT ABILITY GROUPS

Group	Average Number in each Group	Average I. Q.	Total Number of Errors Found in 7197 Problems	Percentage of Errors per Group	No. Errors per pupil
A	24	115.0	212	16.1 percent	8.83
B	28	107.5	305	23.3 percent	10.89
C	24	98.1	380	29.0 percent	15.83
D	21	88.2	415	31.6 percent	19.76
Total	97		1312		13.52

TABLE IV

THE COMPILATION OF ERRORS MADE IN PROBLEMS GIVEN LATER IN THE YEAR TO DETERMINE WHAT TYPE OF DIFFICULTY PERSISTED AND TO WHAT EXTENT

2413 problems analyzed ..... 823 errors isolated

Division	899 or 37.3 percent	errors 276 or 33.6 percent.
Multiplication	697 or 28.8 percent	errors 303 or 36.8 percent.
Addition and Subtraction	583 or 24.2 percent	errors 121 or 14.7 percent.
Subtraction	234 or 9.7 percent	errors 123 or 14.9 percent.

TABLE V

THE DISTRIBUTION OF TYPES OF PERSISTENT ERRORS

Errors with Signs, 364 or 44.2 percent	Multiplication	166 or 45.6 percent
	Division	130 or 35.7 percent
	Addition	43 or 11.5 percent
	Subtraction	26 or 7.1 percent
Errors in Process, 334 or 40.5 percent	Division	108 or 32.4 percent
	Subtraction	88 or 26.5 percent
	Addition	69 or 20.6 percent
	Multiplication	69 or 20.6 percent
Errors with Exponents, 73 or 8.9 percent	Multiplication	55 or 75.4 percent
	Division	18 or 24.6 percent
	Addition	
	Subtraction	
Arithmetical Errors, 52 or 6.3 percent	Division	20 or 38.4 percent
	Multiplication	13 or 25.0 percent
	Addition	10 or 19.2 percent
	Subtraction	9 or 17.4 percent

Multiplication and division evidently presented the greatest number of difficulties. Analyses of the individual papers indicated difficulties with the laws of signs and of exponents in multiplication and division. When both signs were negative, a positive sum or difference was given; four pupils made 31 errors of this kind, and 154 sign errors were made by 12 pupils, indicating that the difficulties were somewhat individual. In the process itself eight pupils made 50 of the errors.

Table VI indicates an inverse relationship between intelligence and errors in algebra.

TABLE VI

THE DISTRIBUTION OF ERRORS IN THE FOUR FUNDAMENTAL PROCESSES AMONG THE FOUR DIFFERENT ABILITY GROUPS (THESE ERRORS WERE FOUND IN 882 PROBLEMS IN THE SOLUTION OF EQUATIONS)

Average Number in Group		Average I. Q.	Total Number of Errors	Percent of Errors	Number of Errors per pupil
A	26	115	22	13.9	.84
B	28	107.5	42	26.6	1.50
C	24	98.1	43	27.2	1.79
D	23	88.2	51	32.3	2.21
Total	101		158		1.73 Av. per Pupil

Remedial work.—Need for remedial work often follows group teaching. Arousing the curiosity and interest of pupils and securing their attention, together with abundant drill, may reduce errors to a minimum, but errors are likely to occur in the work of the most capable pupils. The plan followed with these pupils was that of practice, test, further practice, test, and so on to mastery.

Upon the basis of results of the tests the pupils were divided into sections. The sections which showed sufficient skill in the principle taught

TABLE VII

ADDITION SCORES BEFORE AND AFTER REMEDIAL WORK

Group	Number of Pupils in Group	Perfect Scores in the First Test	Perfect Scores in Retest
A	24	12	12
B	30	17	13
C	22	10	12
D	24	10	14

TABLE VIII

INDIVIDUAL SCORES ON THE SUCCESSIVE TESTS

Group	Pupil	Test I	Test II	Test III
A	1	96	100	
	2	96	100	
	3	90	100	
	4	96	100	
	5	96	92	100
	6	84	100	
	7	76	76	84
	8	92	100	
	9	88	100	
	10	92	100	
	11	76	76	76
	12	32	72	84
B	1	88	84	96
	2	76	100	
	3	96	86	absent
	4	88	100	
	5	60	68	90
	6	76	100	
	7	80	100	
	8	72	100	
	9	96	100	
	10	96	100	
	11	96	100	
	12	96	88	90
C	1	92	80	
	2	92	absent	
	3	80	100	
	4	80	100	
	5	80	96	
	6	88	100	
	7	96	100	
	8	80	80	68
	9	80	100	
	10	88	100	
	11	72	80	80
	12	60	60	72
D	1	96	100	
	2	76	92	
	3	68	72	80
	4	72	84	
	5	84	90	
	6	56	84	84
	7	64	90	
	8	84	80	88
	9	88	88	
	10	92	100	
	11	60	72	80
	12	40	60	60
	13	92	84	

were assigned advanced problems in the use of that skill. The errors of the other sections were analyzed to find their causes. Drill was given to fix the correct response. A second test was then given and the same procedure followed. Pupils who showed inability to master the principles after the second retesting were given individual attention, and no further class time was used for their problems.

Tables VII and VIII show a few of the results of the foregoing plan for remedial work with the four different ability groups. The scores represented in the tables were the result of one of the tests given in addition. Table VII gives the number of pupils in each group, the number who had a perfect score, and the number retested in each group. Table VIII presents the scores made by the retested pupils in the different groups on the successive tests.

Case studies.—The following samples of case reports describe some of the pupils who were in the greatest need of individual attention. These pupils were little affected by the general remedial work given in class. Many of them had personality complexes, and their first need was treatment for their mental attitude.

Case I. Boy. I. Q. 120. Group A. Slow but accurate thinker. A pleasing personality, reserved, and appreciative. Marks on tests not indicative of his ability. Would think processes out carefully but could not be hurried. Motor reactions slow. His work nearly always perfect as far as he worked. Analyzed his own errors and remained after school to make corrections. Did not especially care for algebra but "needed it to enter college." Work unfinished on timed tests.

Frequently given twenty minutes drill for speed. Apparently not much gain.

Case II. Boy. 15 years old. I. Q. 103. Placed in the A group; later transferred to the D group. No apparent ability to generalize. Had to be retaught the principle with each new application of it. Negative quantities always gave him trouble. Memory poor, and he forgot the regular details for the heading of his papers. Was willing and anxious to understand the work. Had too many extra-curricular activities.

Had "no time" to come for special help. Arrived just in time for school in the morning; went home at the noon intermission; practiced with the orchestra after school. Manifested a feeling of hurry which increased toward the close

of school. Did the best he could under the circumstances. Given credit for the year's work in algebra. Recommended not to take geometry.

Case III. Boy. Age 15 years. I. Q. 132. Group A. Small for his age and sensitive about it. (Brother two years younger is taller and much heavier.) Never ready to begin, a putterer. On timed tests the last to start and never completed a test. Day-dreamer. Slow reader of problems and would speed up only under pressure. Knew arithmetical combinations. Signs used apparently haphazardly. Logical thinker in verbal problems. Oral recitation better than written. Given drill in the mechanics of getting ready to start test. Required to have necessary tools ready when he came to class. Personally supervised to force his attention and prevent waste of time when directions were given. Needed strong stimuli. Monthly grade of "P" aroused him to the danger of failure and acted as a spur.

Case IV. Girl. Age 16. I. Q. 98. Group C. Erratic worker. Might know the combinations one day and the next day indicate no knowledge of them. Errors made were difficult to analyze. In addition and subtraction of monomials would invariably prefix the sign of the top number. Did not sense the meaning of signed numbers. When asked to explain her results, had an excuse, such as, "Had a headache and couldn't think." Developed ability slightly when working under direct supervision.

Case V. Girl. Age 15. I. Q. 77. Group D. Only pupil to object to being placed in the D. group. Highest score made on any test was 78 percent. Would bring in problems correctly worked and could not "see" why she did not get class assignments correctly. Principles of algebra did not register. Made errors in copy. Failed to keep appointments for help. Apparently made little improvement. Should repeat the second half of algebra.

Case VI. Boy. 14 years old. I. Q. 85. Group B. Made scores equal to the best in any group. Took pride in being the first to hand in contracts. Did contracts for "extra credit." May have been spurred on by the poor record of his older brother with the same I. Q.

Case VII. Boy. 15 years old. I. Q. 65. Group D. Foreign parentage. Changed spelling of his name when he entered junior high school. Foreign language spoken at home. Seldom made oral recitation. "Yes" or "No" answered to questions asked. Written papers neat; would often recopy them to make them so. Acquired some skill in the mechanical processes. Was never sure about results. If asked how he got a certain number, he would immediately erase it. A strong bond between a question and an error. Very self-conscious at first. Could not be induced to go to the board. Understood directions only when put in simple, direct language. Made considerable gain. Was allowed to try the second semester's work. Was placed with a low group of fourteen pupils. Given much individual attention. Seemed encouraged to try, by contact with a group that was having difficulties as numerous as his own. Had serious difficulty with equations, because he did not sense their meaning; would write $\begin{matrix} x = 3 \\ 2x = 2 \end{matrix}$. Made errors in copy. Exponents gave him the greatest trouble. All his work was done under direct supervision. No home work given him. Neatness of his papers was praised. Great improvement shown in his personal traits. Willingly went to the board. Ceased to erase his work when asked to explain it. Volunteered to recite. Made effort to do assigned problems. Succeeded with simple problems. Plan was to allow him a year's credit in general mathematics. He did not appear for the final examination. Reason not yet known. His case still pending.

Summary and conclusions.—As a result of the foregoing analyses we find that the processes of multiplication and division presented the greatest number of difficulties in proportion to the number of problems solved. Even after remedial work and drill were given, difficulties in these processes persisted. The well learned laws of signs and of exponents became an interference, especially in the combining of the partial products in multiplication.

The greatest difficulty encountered in all the processes was in the use of signs. Of the 1312 errors isolated in the 7197 problems analyzed, 24.6 percent were caused by the use of the wrong sign. As the pupils became more familiar with signs, this difficulty diminished. The errors

were not confined, however, to the algebraic quantities. Combinations involving arithmetical computations were not sufficiently automatic. Errors in coefficients are so closely related to the arithmetical process that they may properly be classed with them. Arithmetical errors and errors in coefficients furnished 10.6 percent and 11.2 percent, respectively, of all the errors located.

Algebraic quantities with a coefficient of one invariably caused trouble in the addition and subtraction processes. A polynomial which had to be arranged in logical order as it was copied from the board also caused trouble both in the arrangement of the quantities and in the distinction between the different powers of any one letter. This difficulty disappeared as the pupils became better acquainted with algebraic terms. Aside from difficulties with signs, the next greatest trouble in subtraction was with problems whose subtrahends were larger than their minuends. The unusualness of seeming to take a larger number from a smaller one caused trouble for many pupils at the beginning of the work. The use of the parenthesis in multiplication was evidently associated with its use in subtraction and was thus the cause of errors in the removal of parentheses in multiplication. There were more unfinished problems in division in proportion to the number of problems solved than in any of the other fundamental processes. This was probably due to the complications of the process itself.

The average number of errors per pupil bears an inverse ratio to the average intelligence quotient of the group. Specialized drill reduced the difficulties and aided in the assimilation and application of correct principles. As compared with other classes, the pupils in all groups acquired either an increased ability in algebra or improved attitudes toward its problems, while pupils of low ability groups avoided failure.

TESTING WORD DIFFICULTY

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THE basic fact to be remembered in testing for word difficulty is that we are testing the words and not the children. When we are comparing children with one another as to word knowledge, we must make sure that conditions are the same for the various subjects taking the test. Often imperfections in the test do not matter because they affect all the subjects alike and do not change our comparison of one to another. In the present discussion, the situation is quite different. We are comparing words with other words as to difficulty. The conditions must therefore be the same *for the different words* as well as for the children taking the test. Concretely, this means that the test must give on each word neither more nor less help than it gives on any other. Here is the difficulty that all so-called objective methods must encounter. Can a test which aids recall by multiple choice, matching items, classification, completion sentences or the like give just as much help on one word as on another?

The fact is that objective tests, in aiding the pupil in recall, do give unequal aid on different words. In determining word difficulty we are comparing words with one another. A test which gives more suggestion on one word than on others will get results which make that word seem easier than it really is. This unequal suggestion is absolutely inseparable from aided recall. If we think of ourselves as testing the children, this difference between words need not bother us but if we are testing the *words* it is of the utmost importance. This situation will be shown in the experimental results presented in this paper. The effect of skillful guessing is really a part of the same problem. As soon as *any* help in recall is given, it is possible for intelligence to build upon the suggestion and get the right answer. And the suggestion upon different words is bound to be unequal, so that intelligence finds some items on the test easier than others.

THE EXPERIMENT

The following experiment is reported as suggestive of a satisfactory method of testing the relation difficulty of the commonest meanings of words with older children. It does not pretend to show a method of testing the less usual meanings of words or of testing word knowledge at all below, let us say, the fourth grade. Those situations have to be studied under their own conditions.

This experiment was conducted with 40 children of grade VI. First, seventy words were presented to them in columns with the instructions that they help the teacher find out the hard words. They were, therefore, to mark with a zero all words which they did not know at all and with a question mark the words about which they were uncertain. In the scoring, only those words which were not marked in either way were considered as known. Immediately after this word checking test, the same 70 words were presented to the children in a multiple choice test having the form "Skill is keenness, anger, grief, expertness;" this being the printed form of a vocabulary test of good standing. On both tests, the children were given all the time they could use. When taking the multiple-choice test, the children asked what they were to do if they were not sure which alternate to mark. They were told to mark any one they thought the right one. Some guessing was therefore present, but since scores on the checking test were in most cases higher, the children must have been doing somewhat the same thing there, that is, considering words as known about which they were not entirely sure.

No comparison between total scores made by the class on these two tests would tell us which is the better test, since both tests are on trial.[1]

TABLE I

THE WORD KNOWLEDGE OF 40 CHILDREN OF GRADE VI AS MEASURED BY A MULTIPLE CHOICE TEST AND THE WORD CHECKING TEST

A comparison of class knowledge of individual words as determined by the two types of test

No. of Words	Difference
18	Same on both tests
12	Difference of 1
9	" 2
6	" 3
5	" 4
2	" 5
2	" 6
3	" 8
2	" 9
1	" 10
4	" 11
2	" 12
1	" 13
1	" 17
1	" 21
1	" 23
70 words	

The table should be read as follows: 18 words were known by the same number of children whether tested by either method, 12 words were known by one more child when tested in one of the ways than in the other, 9 words were known by 2 more children, and so on.

[1] Sims, Verner M. "The Reliability and Validity of Four Types of Vocabulary Tests." *Journal of Educational Research.* September, 1929. Tries to tell which type of test is the best by inter-correlation between pupil scores. If the author had given some of the original data showing results on individual words, we could form a better iden of the true validity of the various methods.

The point to remember is the one emphasized above that we are interested in testing words rather than pupils. Therefore, the significant results are to be found when we see what happened on individual words when tested in these two ways. These results upon the separate words we shall now present.

At first the agreement between the results on these seventy words when tested in two ways may seem surprisingly small, but a study of the situation will show that the result is about what could have been expected. First of all, if the children had repeated either kind of test a second time there would have been considerable variation. Second, the methods used by the two tests were so different that variation between them was certain to result. When we have further analyzed results, it will seem strange that there was not more disagreement.

For purpose of analysis, let us consider the 20 words, out of the total of 70, the results on which differed by more than 10 percent of the pupils taking the test. If we look at what happened on these 20 words we will find a series of reasons why the two tests do not agree.

First of all, the multiple-choice test caught some guessing which the children had apparently done on the checking test. Nearly all had marked the word "charter" as known, but half of these on the multiple-choice test said that a charter was a map. They must have been confusing it, therefore, with "chart." The evidence seems to show that the same sort of thing happened with "embody" and "limpet," a familiar part of a word making the children think they knew the meaning of the whole.

Second, if the multiple-choice prevented use of partial word knowledge with these three words, it *assisted* partial word knowledge in even more cases. Table II shows six words with the alternates given on the multiple-choice test. In the first four cases, a part of the hard word was similar in meaning to the correct easy word which followed, as in the resemblance between "gelatinous" and "jellied." In the case of "mosaic," if the word had been heard in connection with decoration, this idea would have helped the pupils to select "patterns," as the correct response. The word "ape" in "apish" would have helped the children to decide that of the four alternatives "silly" was the most appropriate. The point is that in these six words the big difference between the results on the two tests seems to be explained by *the aid which the multiple-choice form gave.* As emphasized above, any kind of the so-called objective test is bound to aid recall. The difficulty is that it does not

give equal aid on different words. Likewise, as we shall show at once, it may positively hinder the children from showing their knowledge in the case of some words.

TABLE II

WORDS ON WHICH MULTIPLE CHOICE TEST AIDED PUPILS

M-C Test	Checking	Dif.	Wording of Multiple Choice Test
25	12	13	Gelatinous things are jellied, coetile, round, Italian.
39	28	11	A sportive person is gay, wild, bold, cruel.
26	9	17	Disproportionate amounts are rough, unequal, fair, equal.
15	7	8	An incrustation is a absorption, coating, petrification, indentation.
26	14	12	Mosaic reveals homogeneity, patterns, melody, stripes.
19	8	11	Apish people are cruel, silly, wise, angry.

Of the twenty words out of the total of 70 that differed most widely on the 2 tests, we have shown that three are undoubtedly too high on the checking test, and that 6 are probably too high on the multiple-choice test. In Table III, we present results which seem to show that of the remaining eleven, nine probably are too low on the multiple-choice. We believe that examination of every one of these cases will show that there was in the multiple-choice form some characteristic that hindered some of the children from marking the words properly. In some of these cases, such as the one which gives "singularity" as a substitute for "peculiarity," the substitute is harder than the original word. In others, such as in the case of giving "sleep" for "repose," the words are not always thought of as the same thing. In other cases, the alternatives were confusing and must have led some of the children to mark the wrong thing or omit the item. A very clear case is the word "roar," not given on this table. Surely, all sixth-grade children know what the word "roar" means. All 40 of the children in this class marked it as known on the checking test, but four of them passed over it on the multiple-choice form. When we note that the test said, "A roar is muddy, tall, soft, loud," one can well imagine that some of the children began to be doubtful whether they knew the word or not. In fact, an inseparable part of the multiple-choice technique is wrong suggestion, and this is certain to shake the confidence of many children.

TABLE III

WORDS ON WHICH MULTIPLE-CHOICE TEST HINDERED PUPILS

M-C Test	Checking	Dif.	Wording of Multiple Choice Test
13	35	22	A peculiarity is a circuit, debacle, singularity, uniformity.
9	21	12	Exaltation is intoxication, exhalation, elation, admonition.
29	40	11	Skill is keenness, anger, grief, expertness.
28	39	11	A priceless book is useless, invaluable, princely, excellent.
29	38	9	A shrewd man is weak, dull, sharp, strong.
8	16	8	A promontory is a promoter, incognito, foreboding, projection.
18	26	8	A dilapidated thing is laminated, complete, subjected, defaced.
34	40	6	Noticeable things are round, little, brave, plain.
26	31	5	To repose means to sleep, snore, dream, wake.

Of the words which varied on the two tests by more than 10 percent of the children taking the test, we have two remaining: "tolerate" and "civil." The conditions of the testing seem to offer no explanation for the difference in results secured by the two methods. We can find no suggestion, therefore, as to which of the tests shows the true amount of word knowledge on the part of the children.

We have here illustrated a characteristic of objective tests which it is almost impossible to get away from: with some words they aid the pupil and with others they hinder him, doing each in unequal amounts for different words. Consequently they often fail very decidedly in showing us the *true relative difficulty* of words. In this experiment we were using the multiple-choice items which appear on a standard published test. It might be argued that these could well be improved upon. Yet any multiple-choice items would be subject in greater or less degree to the same difficulties. Again we must remind the reader that we are not thinking of fairness to the children, but are seeking to get results on individual words which are comparable with one another. In using any method of aided recognition, it is going to be impossible to give equal aid on all words or, as in the cases shown above, to keep from actually hindering recognition in the case of some.

COMBINING THE METHODS

From the reasoning suggested by the experiment just described, we may propose a method of testing common meanings with older children which will meet as far as is possible the demands of accuracy and ease of application. Where large word-lists are to be dealt with, we propose that they first be presented to children in a checking test. From this test a smaller list of doubtful cases will be secured. We propose that this list be then presented to a large number of children first by the checking method and then by the so-called objective method. Both of these techniques are easy to administer. Each one acts as a check upon the other because the mistakes which one is likely to make are very unlikely to be repeated in the other method.

The two tests will agree on a very large percentage of the words and concerning those words we can then be rather sure that we do know the relative difficulty for the particular grade in which they were tested. There will remain, however, a group of words on which these two methods of testing do not agree. These words may be tested again either more widely or with new forms of objective tests to make sure whether the

disagreement is unavoidable. If the difference in results persists, these few words would have to be investigated by the interview technique. This would be possible because of their small number. Of course, the interview technique would be checked by specifying permissable and non-permissable responses.

As explained at the outset, the only final method of determining relative word difficulty is by testing. We must insist that test results be accurate, but because of the large number of words and the vast number of school children, we must also have ease of application. We believe the composite method outlined above would get these two requirements as far as is possible in the largest word testing job that is before us, that is, determining the relative difficulty of the ordinary meanings of words to the children of the middle and upper grades.

COMPARISONS OF SHORT ANSWER AND MULTIPLE CHOICE TESTS COVERING IDENTICAL SUBJECT CONTENT

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Validity of test materials is of vital concern. Does a test measure what we wish it to measure? Does it measure the desirable outcomes of the course? Does it measure the objectives set for the course? Before the advent of the "new type" tests, "essay" examinations were the most common type of test. The "new types" have been proven more reliable in giving the same rating when repeated. This reliability has been gained largely by making less ambiguous, more definite, and more objective test items. Some data have been given to show that "essay" tests may be made quite reliable if care is taken in framing test questions and objective scoring keys are used. In general it must be admitted that "essay" tests involve more creative capacities of individuals in that they give more opportunity for self-expression.

The short answer test is the nearest like the "essay" test though it lacks the creative opportunities of the latter. It calls for a definite answer to a definite query, breaking up the desired "essay" responses into more unitary portions, thus steering the student along a path chosen by the test constructor, absolving him from fashioning the pattern of the responses. An uncompleted statement test is probably the next nearest relative of the "essay" test but seemingly a trifle less satisfactory than the short answer test on the whole because the blanks to be filled in are not always so pointed as the short answer test items. A series of blanks may be filled in so as to give a quite different trend to the thought and yet be quite accurate.

The multiple choice test introduces a quite different element—that of selection among several alternatives. No creative ability is brought into play nor is there any leeway for a student's choice of words from his own vocabulary. Ability to choose the best of several responses is the ability required. The test is thus usually 100 percent objective. This discussion presents evidence on computed reliability and validity of the short answer (Form A) and multiple choice (Form B) types of test when the subject content was planned to be identical in the two. Form B (multiple choice) was prepared after Form A and each item paralleled a corresponding item in Form A. In Form A a definite query required a definite response not suggested to the student. He had to furnish the information or judgment from his own accumulated experiences. In

Form B, four responses were suggested, one of which was more nearly correct than any of the others. He had to select the most nearly correct one of the four suggested. For example, item 19 of Form A reads, "How is the voltage appreciably affected when some lights in a house are turned off?" The corresponding item in Form B reads, "When some lights in a house are turned off, the voltage (a) increases; (b) decreases; (c) remains the same; (d) constantly fluctuates through a wide range."

In the first place, Form B proved to be an easier test. On administrations of both forms after fifteen days of instruction in 36 schools on a teaching unit for which the tests were prepared, the mean scores for Forms A and B, respectively, for 1423 pupils were 52.38, and 57.77. (The total possible score on each is 79.) Form B was given one day later than Form A without intervening instruction. The two forms were also used as preliminary tests but not with the same pupil groups for each. For 950 pupils in unselected classes, the mean score for Form A was 20.14; and for Form B, for 774 pupils, 32.57. The evidence seems conclusive that Form A is more difficult especially when used as a preliminary test. The distribution forms and computed variabilities for the final tests are quite similar, the scores showing concentration toward the high end. For the preliminary test however, the two distributions are quite different. While the computed variabilities are approximately the same, the distribution for Form A shows concentration toward the low end, and for Form B, a more nearly normal trend. Percentile graphs and standard deviation graphs show that A is more difficult all along the scale for both preliminary and final scores.

Computed reliability coefficients by the "split-halves" method are .93 ± .01 for Form A final, and .82 ± .02 for Form B. Form B is less reliable probably because pupils are less careful in making the responses, due to its apparent ease. This unreliability of Form B shows up in the correlation coefficient between the two forms which is .78 ± .02. This indicates also that the two tests do not measure exactly the same functions. In other words, both are not equally valid in measuring the planned outcomes of the instructional unit.

Two other coefficients of correlation indicate the higher validity of Form A. A third form, Form C was used with a few schools. This is the form appearing in a work and test book by the writer.[1] For Form A, the coefficient with Form C is .88 ± .02; and for Form B, .68 ± .04.

[1] Hurd, A. W. *Work Test Book in Physics.* New York: The Macmillan Company, 1930.

These coefficients show that Forms A, B, and C do not measure the same functions, *i.e.*, they are not equally valid for measuring the planned outcomes of the unit of instruction. In other words, if the unit is planned to produce pupil facility in giving correct responses to certain definite short answer items, it is not equally well designed to produce pupil facility in selecting best answers (as in Form B) or giving right answers to test items in Form C. Test items for instructional units should be devised to measure the planned outcomes of the unit in the form in which they were considered in the unit. The short answer test is probably the most satisfactory as an objective test. Other "new types" may involve different functions which the unit was not designed to exercise. That Form A is probably superior is substantiated by the comparative gains made on Forms A and B from preliminary to final test. These are, respectively, 32.24 and 25.20. It seems that instruction has produced a higher gain with Form A and it may be assumed that instruction produces greater effects in the direction of its planned objectives. Therefore, Form A is a more valid test for the unit.

While "new type" tests are novel and interesting, it must be observed that they may introduce functions which the unit was never intended to strengthen. A measurement test should be carefully planned to measure the intended unit outcomes in order to be a valid measuring device.

A COMPARISON OF THE PERSONALITY TRAITS OF 300 ACCELERATED, NORMAL, AND RETARDED CHILDREN*

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THE personality traits of school children, even when given instruction in large groups, are very marked. Some are attentive and interested in their work, while others are talkative, restless, or indifferent. Some are disobedient or quarrelsome, but the majority get along well with other children.

The purpose of this study was to make a comparison of the degree to which certain desirable and undesirable traits were possessed by children whose school progress had been normal, accelerated, or retarded. A child was considered retarded if he had been left back one or more terms. An accelerated child was one who had been doubly promoted once or more than once. The amount of retardation ranged from one to five terms and that of acceleration from one to three terms.

In connection with an experiment on retardation at Public School 208, Brooklyn, the teachers of the second, third, and fourth grades were asked to indicate which of the following characteristics described each of the children in their classes.

1. Gets along well with other children
2. Interested in school work
3. Good effort
4. Quiet
5. Attentive
6. Obedient
7. Calm
8. Quarrels with other children
9. Indifferent toward school work
10. Excitable
11. Talkative
12. Restless
13. Stubborn
14. Listless

From this group one hundred children were selected whose school progress had been accelerated, one hundred who had been promoted regularly, and a third hundred whose school progress had been retarded. There were fifty boys and fifty girls in each group, with an equal amount of retardation and acceleration among both the boys and the girls.

The first seven traits were considered desirable and the remaining seven undesirable. Table I makes a comparison of the desirable and undesirable traits for three groups of children, the boys and girls being listed separately.

* Miss Mildred Borst and Miss Miriam Eggers, assistant psychologists in the Department of Ungraded Classes, New York City, rendered valuable assistance in giving and scoring the association tests.

TABLE I

PERSONALITY TRAITS OF 300 ACCELERATED, NORMAL, AND RETARDED CHILDREN

	Accelerated			Normal			Retarded		
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total
Desirable									
Gets along well with others	36	34	70	30	32	62	33	28	61
Interested in school work	45	42	87	36	33	69	19	33	52
Good Effort	40	42	82	29	29	58	18	22	40
Quiet	22	31	53	17	22	39	17	24	41
Attentive	30	36	66	22	22	44	16	23	39
Obedient	32	33	65	30	28	58	22	24	46
Calm	20	17	37	7	13	20	7	12	19
Undesirable									
Quarrels with others	3	0	3	6	7	13	5	10	15
Indifferent toward school	1	0	1	9	9	18	21	11	32
Excitable	5	4	9	5	10	15	7	6	13
Talkative	16	10	26	20	22	42	21	24	45
Restless	8	4	12	12	14	26	20	12	32
Stubborn	1	0	1	4	8	12	7	6	13
Listless	1	1	2	3	4	7	10	8	18

The differences in personality traits between the boys and girls were practically negligible, except in the group of retarded children. In this group the girls were more attentive and more interested in their school work than the boys. They were also less restless and less indifferent toward their school work than the boys.

The desirable traits for the three groups of children are shown graphically in Chart I and the undesirable traits are shown in Chart II. The open bar represents the accelerated children, the solid bar the children who have made normal school progress, and the bar with diagonal lines the retarded children.

CHART I. COMPARISON OF DESIRABLE TRAITS FOUND IN 300 ACCELERATED, NORMAL, AND RETARDED CHILDREN

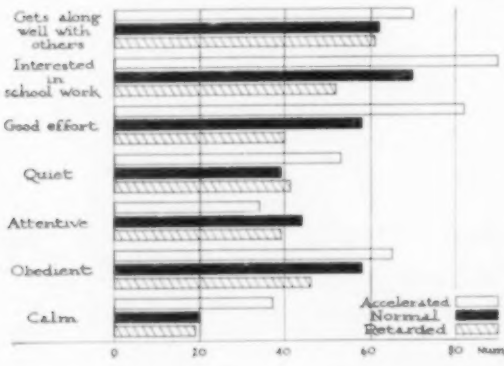
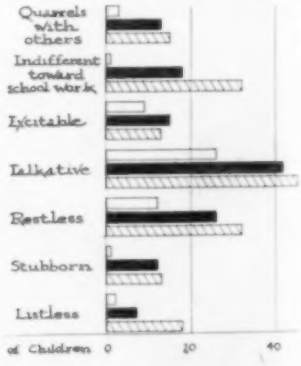


CHART II. COMPARISON OF UNDESIRABLE TRAITS FOUND IN 300 ACCELERATED, NORMAL, AND RETARDED CHILDREN



By comparing the two charts it is very evident that all three groups possessed more desirable than undesirable traits. In general, the accelerated children seemed to possess to a greater degree all the desirable traits than did the retarded children. The reverse condition was true of the undesirable traits.

Further analysis shows that all three groups got along well with other children. The accelerated children excelled in their interest in school work and in good effort. With the exception of attentiveness, they possessed all the desirable traits to a greater degree and the undesirable traits to a less degree than the other two groups of children.

The retarded children were markedly disinterested in and indifferent toward their school work. Their effort was considerably less than that of the children whose school progress had been normal. Although the retarded children were the most disobedient of the three groups, they compared favorably with the children of normal school progress with regard to quietness, calmness, quarrelsomeness, stubbornness, excitability, and talkativeness.

The Kent-Rosanoff Association Test was given individually to forty-five of the children who possessed several of the undesirable personality traits. All of them were considered conduct problems by the school, and twenty-two of them had been retarded in school progress.

On the association test the term "individual reaction" is applied to a response which is different from those usually given by normal children. An excessive number of individual reactions given by any one person is considered a symptom of emotional instability. Sufficient work has not been done with younger children to establish norms for them. Investigators[1] have found, however, that younger children tend to give more individual reactions than those who are over sixteen years of age. For the latter group, more than ten individual reactions is considered an excesssive number. The findings on the Kent-Rosanoff Association Test suggest that emotional instability may be a causative factor in the anti-social behavior of these problem children, as fourteen of them gave more than thirty individual reactions, the average number for the group being twenty-four.

RECOMMENDATIONS

The principal causes which result in retarding the school progress of a child may be classified under three heads: mental, physical and

[1] McElwee, Edna Willis. "Association in Normal and Sub-Normal Adolescents," *American Journal of Psychiatry*, September, 1931.

emotional. There is always a reason why a child falls behind his class. An examination by the school psychologist will determine his mental capacity and will show whether his grade placement is correct. The school doctor will advise regarding poor vision, impaired hearing, under nourishment, or other physical defects which can be corrected. If the child is quarrelsome or disobedient, and just as surely if he is listless and unresponsive, the diagnosis and treatment of the psychiatrist will be helpful in removing the causes of retardation.

When the psychologist, physician, and psychiatrist have done what they can, the rest is up to the teacher. Her greatest problem will be to create an interest in school work. The results of repeated failure and discouragement, after honest efforts to complete tasks too difficult for them, must be overcome. An activity program which allows for both class and individual projects may be the means for the retarded child to find himself.

Two of the problem cases in this study were twelve-year-old boys in the fourth grade. Their educational attainment was even below the level of that grade. They were placed in an opportunity class with a more flexible program and a sympathetic teacher. One of the boys showed an interest in ships and was permitted to build several models of various kinds. He was very proud of his ships and could tell visitors all about them. It was the first time he had done anything well at school. By this accomplishment he had regained his self-respect as a member of the group and was no longer a disturbing element in the classroom. He was now willing to try to learn to read, and the words he used in telling about his ships were the first ones he learned.

The other boy was the quiet unresponsive type. The class was building rabbit hutches for the school garden and he knew more about carpentry than the other boys. He was allowed to direct them in small groups. It was surprising what a difference this opportunity for self-expression made in him personally. His desire to learn had been awakened and by the end of the term he had completed the work of two terms.

A STUDY OF THE AMOUNT OF AGREEMENT FOUND IN THE RESULTS OF FOUR EXPERIMENTERS EMPLOYING THE SAME EXPERIMENTAL TECHNIQUE IN A STUDY OF THE EFFECTS OF VISUAL AND AUDITORY STIMULATION ON LEARNING

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The point has frequently been made that the antecedents of educational phenomena should be so controlled and the procedures employed so reported in experimental studies of education that other experimenters may secure upon the repetition of the reported experimenters comparable results. As a matter of fact, the whole program of experimental education is based upon the assumption of the repeatability of educational experimentation. If one examines the experimental studies relating to a given phase of education, he is almost certain to be impressed by the lack of agreement in the results reported by different experimenters. While the procedures are almost never identical, some individuals have interpreted this lack of agreement as evidence of the impossibility of experimentation in a complex field such as education. With this thought in mind, the study here reported was undertaken to determine the amount of agreement in the results of four experimenters using the same technique in a study of the effects of visual and auditory stimulation upon learning.

PROCEDURE

Four experimenters and sixty-four subjects were used in the experiment, each experimenter working with sixteen subjects. The subjects were chosen from members of the freshmen class of the University of Wisconsin, from pupils enrolled in the University of Wisconsin High School, and from pupils enrolled in two rural high schools in the vicinity of Madison, Wisconsin. All subjects were between the ages of fifteen years, zero months and eighteen years, zero months.

The procedure pursued in this study was devised as a group project in Education 108, Experimental Education, Department of Education, University of Wisconsin. The materials used for the measurement of learning were verbal, consisting of two lists of ten nonsense syllables each selected from "zero association value" list of Glaze, and two lists of paired associates of fifteen pairs each, selected from a list of sixty words taken at random from a psychological study.

The two lists were reproduced in mimeographed booklets (known as X and Y), one of which was used by the subject in the control (unstimulated) situation, and one in the experimental situation. General directions both for experimenters and subjects were prepared to minimize the amount of uncontrolled verbal communication between subject and experimenter. These directions and the booklets, X and Y, are reproduced below.

The experiments were conducted in a partitioned booth, about 4x6 feet, in a large laboratory. The subject sat at a table with booklets X and Y, and the general instruction sheet before him. He was observed by the experimenter through a slit in the partition at the rear of the subject. A telegraph sounder on the subject's left clicked when the subject was to turn to the next page of the booklet.

Auditory stimulation was supplied by means of a buzzer actuated by ordinary lighting current cut down through a rheostat. The visual stimulation was from a 150-watt light. The two, located in the booth three feet above and three feet to the left of the subject's head, were actuated simultaneously by a telegraph key under the hand of the experimenter, the stimuli period being given irregularly in a predetermined order and for approximately constant periods of time. Each experimenter followed the same schedule, timing the procedure with a stopwatch. A practice period was introduced prior to the experiment proper.

Each individual acted as his own control. To allow each subject to participate in both halves of the experiment, it was necessary to equalize the difficulty of booklets X and Y. The equalization was made on the basis of the pooled opinions of the members of the class in experimental education. The following learning program was pursued by each experimenter.

S: 1 Control first; booklet X
Experimental second; booklet Y
2 Control first; booklet Y
Experimental second; booklet X
3 Experimental first; booklet X
Control second; booklet Y
4 Experimental first; booklet Y
Control second; booklet X

The same cycle was repeated four times by each experimenter so that in the final analysis of group results, practice, fatigue, and relative difficulty of lists were systematically varied.

When each experiment was completed, the booklets were collected and scored. The nonsense syllables were given scores as follows: 3 points for a perfect syllable, 2 for two letters correct, and 1 for a single letter correct. The paired associates were scored by giving two points if the words were correctly recalled and attached to the proper stimulus word, and one point if the words were correct but attached to the wrong stimulus word.

Other data which were collected for each subject were his height, weight, chronological age, and I.Q.*

GENERAL DIRECTIONS TO THE SUBJECTS

(page 1)

(Time 1 minute)

We want to discover some facts about memorizing. The value of your work depends as much upon how well you follow directions as it does upon how well you memorize.

There are really only two steps in this experiment: 1. You will be asked to memorize a set of meaningless syllables and write what you have memorized; and 2. you will memorize pairs of words and reproduce upon request as many of them as you can.

When it is time for you to stop one part of the experiment and begin the next, the key in front of you will click. Follow this one rule throughout the experiment:

WHENEVER THE KEY CLICKS, TURN TO THE NEXT PAGE.

Do the best that you can in the time that you have.

When the key clicks, turn this page.

(page 2)

(Time 1 and ½ minutes)

You are to memorize these syllables and then rewrite them from memory. Concentrate on the list, learning the syllables by whatever method you ordinarily use for memorizing.

gij	vec
meq	cij
wuh	zeq

When the key clicks, turn the page.

(page 3)

(Time ½ minute)

* Only a partial analysis of the data are presented herein.

Write what you have memorized:

....
....
....

Do not turn the page until the key clicks.

(page 4)

(Time 1 and ½ minutes)

Here is a list of paired words. Learn the pairs of words reproduced below so that when you see the first word of each pair you can write the second from memory.

secure — while	which — about
trend — smash	arise — labor
steel — anger	shoot — fault

When the key clicks, turn the page.

(page 5)

(Time ½ minute)

In the space following each word write from memory the word associated (paired) with it.

which —	secure —
steel —	shoot —
trend —	arise —

Do not turn the page until the key clicks.

(page 6)

Take the booklet which lies in the left-hand corner of the table and begin work on page 1, at once.

(The key will not click again until you have finished page 1.)

BOOKLET X

(page 1)

(Time 3 minutes)

Memorize the following list:

dax	xad
zij	vuk
gah	hyh
jex	vaf
yil	gaq

Work until the key clicks.

(page 2)

(Time 1 minute)

List 1

Write what you have memorized:

....
....
....
....
....

Do not turn the page until the key clicks.

(page 3)

(Time 3 minutes)

List 2

Memorize the following pairs:

basic — later
phase — order
dream — center
stand — some
habits — term
skill — often
facts — delve
china — other
sense — ideal
innate — give
type — then
content — drama
form — haunt
carry — simple
most — until

Study until the key clicks.

(page 4)

(Time 1 minute)

In the space following each word write from memory the word associated (paired) with it.

dream —
habits —
facts —
sense —
type —
form —
most —
stand —
phase —
skill —
basic —
china —
innate —
content —
carry —

Do not turn the page until the key clicks.

BOOKLET Y

(page 1)

(Time 3 minutes)

Memorize the following list:

zif	qih
gex	mef
yim	wub
jid	cef
xej	sij

Work until the key clicks.

(page 2)

(Time 1 minute)

List 1

Write what you have memorized:

....
....
....
....
....

Do not turn the page until the key clicks.

(page 3)

(Time 3 minutes)

List 2

Memorize the following pairs:

idea — here	nature — part
bias — shred	coin — rose
tense — brush	toned — ball
gout — rule	leave — orchid
datum — food	pencil — unable
social — rack	value — monism
work — evoke	even — upon

norms — grape

Study until the key clicks.

(page 4)

(Time 1 minute)

List 2

In the space following each word write from memory the word associated (paired) with it.

tense —	gout —
datum —	idea —
norms —	social —
nature —	work —
toned —	coin —
pencil —	leave —
even —	bias —

value —

Do not turn the page until the key clicks.

RESULTS

The data collected by the four experimenters were examined from four points of view: 1) The results secured by the four experimenters were examined for consisteney; 2) the results secured by the four experimenters were compared with the composite result for all subjects and experimenters; 3) the results secured by each experimenter were compared with those secured by all other experimenters; and 4) the spread of the scores secured by the four experimenters was compared on the assumption that experimental errors should increase the sigmas of the distributions. Any unusual fluctuation in the subjects of a given experimenter should thus be detected.

The mean scores obtained by the four experimenters are reproduced in Table I. The differences for the means of the control and experimental situations, for the four experimenters, are reproduced in Table II. When the size of the several means are compared they appear to vary at random except for experimenter Z whose results are consistently

TABLE I

RESULTS OBTAINED BY FOUR EXPERIMENTERS WHOSE SUBJECTS LEARNED NONSENSE SYLLABLES AND PAIRED ASSOCIATES UNDER EXPERIMENTAL AND CONTROL SITUATIONS

CONTROL SITUATION

		Nonsense Syllables			Paired Associates		
Exper.	N	Mean Score	$S.D._{dis.}$	$S.D._{mean}$	Mean Score	$S.D._{dis.}$	$S.D._{mean}$
X	16	19.38	5.20	1.30	15.25	6.42	1.61
Y	16	22.31	5.58	1.40	16.00	7.98	1.99
Z	16	19.30	5.16	1.29	14.19	8.18	2.05
Q	16	18.25	5.10	1.28	16.19	6.89	1.75

EXPERIMENTAL SITUATION

		Nonsense Syllables			Paired Associates		
X	16	17.81	6.18	1.55	11.44	7.26	1.82
Y	16	16.88	5.36	1.34	14.75	8.18	2.05
Z	16	15.63	6.40	1.60	13.19	6.94	1.74
Q	16	18.38	6.56	1.64	14.69	6.63	1.66

lower than those secured by the other experimenters. While there is considerable variation in the differences between the means of the control and experimental situations secured by the four experimenters, in no instance are these differences statistically significant. The differences are greatest in the case of experimenters Y and Z for nonsense syllables, the critical ratios being 2.81 and 2.13. Even in these instances the differences may be attributable to errors of sampling.

TABLE II

A Comparison of the Differences in the Means Secured by the Four Experimenters Under the Control and Experimental Situations

NONSENSE SYLLABLES

Experimenter	Mean difference: (C minus E)	$S.D._{diff}$	Critical Ratios	Chances in 100 of a true diff. greater than 0
X	1.57	2.02	.78	78
Y	5.43	1.93	2.81	99
Z	4.37	2.06	2.13	98
Q	—.13	2.08	.06	52

PAIRED ASSOCIATES

X	3.81	2.42	1.57	94
Y	1.25	2.86	.44	66
Z	.31	2.68	.12	54
Q	1.50	2.41	.62	74

TABLE III

A Summary of the Results Secured for all Subjects and Experimenters

	Nonsense Syllables		Paired Associates	
	Experimental Situation	Control Situation	Experimental Situation	Control Situation
Mean	17.17	19.73	13.52	15.41
σ dist.	6.03	5.63	7.44	7.44
σ ave.	0.75	0.70	0.93	0.93
Diff. (C-E)	2.56		1.89	
σ dif.	1.030		1.315	
Critical Ratio	2.48		1.43	

TABLE IV

A Comparison of the Differences of the Differences of the Means Between the Control and Experimental Situations for the Several Pairs of Experimenters

NONSENSE SYLLABLES

Experimenters	Diff. of a Diff.	$S.D._{diff.\ of\ diff.}$	Critical Ratios	Chances in 100 of a true diff. greater than zero
Y – X	3.86	2.79	1.39	92
Z – X	2.80	2.88	.97	83
X – Q	1.70	2.90	.59	73
Y – Z	1.06	2.82	.38	65
Y – Q	5.56	2.84	1.96	98
Z – Q	4.50	2.92	1.54	93

PAIRED ASSOCIATES

X – Y	2.56	3.75	.68	75
X – Z	3.50	3.60	.97	83
X – Q	2.31	3.42	.68	75
Y – Z	.94	3.92	.24	60
Q – Y	.25	3.74	.07	50
Q – Z	1.19	3.60	.33	63

A composite of the results secured for all subjects and all experimenters is reproduced in Table III. While the differences presented in Table III are not statistically significant, they favor the control situation. An examination of the differences secured by the four experimenters (Table II) indicates a similar result, the means, except one, favoring the control situation. The differences here as in the composite results are statistically insignificant. A comparison of the mean differences between the control and experimental situations for the several pairs of experimenters is presented in Table IV. While there are variations in the results secured by the four experimenters, in no instant are the mean differences statistically significant. Finally, the spread of the distributions secured by the different experimenters is presented in Table V. The differences (Table VI) are, however, in no instant statistically significant.

TABLE V

THE SIGMAS OF THE DISTRIBUTIONS SECURED BY THE FOUR EXPERIMENTERS

CONTROL CONDITIONS

Experimenter	Nonsense Syllables σ dis.	$\sigma\sigma$	Paired Associates σ dis.	$\sigma\sigma$
X	5.20	.919	6.42	1.136
Y	5.58	.986	7.98	1.411
Z	5.16	.912	8.18	1.446
Q	5.10	.901	6.89	1.218

EXPERIMENTAL CONDITIONS

	Nonsense Syllables		Paired Associates	
X	6.18	1.092	7.26	1.283
Y	5.36	.947	8.18	1.446
Z	6.40	1.131	6.94	1.227
Q	6.56	1.160	6.63	1.172

TABLE VI

THE STATISTICAL SIGNIFICANCE OF THE DIFFERENCE IN THE SPREAD OF SCORES SECURED BY DIFFERENT EXPERIMENTERS

CONTROL SITUATION

Experimenters	Nonsense Syllables Sigma Differences	diff.	Critical Ratios	Paired Associates Sigma Differences	diff.	Critical Ratios
Y – X	.38	1.348	.282	1.56	1.811	.861
X – Z	.04	1.295	.031	—1.76	1.839	—.957
X – Q	.10	1.287	.078	— .47	1.666	—.282
Y – Z	.42	1.343	.313	— .20	2.020	—.990
Y – Q	.48	1.336	.359	1.09	1.864	.585
Z – Q	.06	1.282	.047	1.29	1.891	.682

EXPERIMENTAL SITUATION

	Nonsense Syllables			Paired Associates		
X – Y	.82	1.445	.567	— .92	1.933	—.476
Z – X	.22	1.572	.140	— .32	1.775	—.179
Q – X	.38	1.593	.239	— .63	1.738	—.363
Z – Y	1.04	1.475	.705	—1.24	1.896	—.654
Q – Y	1.20	1.497	.801	—1.55	1.861	—.833
Q – Z	.16	1.620	.099	— .31	1.697	—.183

SUMMARY STATEMENT

(1) The purpose of this study is to test experimentally the amount of agreement found in the results of four experimenters employing the same experimental procedure in a study of the effects of visual and auditory stimulation upon learning.

(2) The results show that four experimenters working under conditions similar to those in this experiment can secure comparable results.

(3) While the number of cases employed in the experiment here reported was small the writer believes that the procedure is suggestive of a means that research workers may employ in testing the adequacy of experimental techniques.

SOME SUGGESTIONS GROWING OUT OF THE EXPERIMENT

The writer believes that the repeatability of experiments is a matter of some importance. On the basis of this belief and the foregoing data he should like to offer the three following suggestions to both consumers and producers of research:

(1) Many of the so-called conflicts in experimental results are really not conflicts but experiments whose procedures, methods of measurements, and subjects differ in some significant respects. It is frequently said that if one were to choose a half dozen experiments relating to a given field of education one would find little or no agreement in the results. While this is, in a manner, true, it is also true that the critical reader will find in these researches not identical experiments with conflicting results but experiments unlike in some material respects. This point is well illustrated by the foregoing experiment. (2) A useful statistical tool somewhat recently introduced into educational research, but one which needs to be employed with considerable care, is the critical ratio. The purpose of this statistical device is to test whether or not the differences obtained in experiments may have arisen *from chance fluctuations in samples*. If one were to draw six balls at a time from a box containing an equal number of red and white balls one would not expect to obtain exactly the same number of red and white balls on each draw. One would expect a certain amount of fluctuation in the proportion of balls drawn. These fluctuations are well illustrated in Table II. On the other hand, if one were in ignorance about the number of red and white balls in the box and continued to draw a larger number of one color than of the other, one would probably suspect eventually that the box contained more balls of this color than of the other. The prob-

ability of this being the true situation is expressed by the *critical ratio*. When this ratio is in the proximity of three it is customary to say that the differences are *statistically significant*. It should be remembered, however, that this significance is merely one of sampling and that it does not supply information about differences emanating from the numerous other unseen and uncontrolled variables of one sort or another. (3) The third suggestion that the writer should like to offer grows out of the use of the argument from *consistency:* when one possesses a certain body of materials, instead of treating them as a whole, it is frequently desirable to divide them at random into smaller samples, and to study each sample independently. Or better yet, it is sometimes desirable to provide, in the plan of the experiment, for a number of smaller experiments which, when repeated under similar conditions, constitute the experiment as a whole. Besides the variations due to errors of sampling there are others due to fluctuations in the performance of the subjects, unintentional changes in procedure, etc. By the use of this device the experimenter introduces, as it were, evidence of the repeatability of his own experiments.

A CRITICAL SURVEY OF PUBLIC SCHOOL COURSES OF STUDY PUBLISHED 1929 TO 1931

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and

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IN February, 1930, we presented in this journal a critical survey of courses of study published in 1928-1929. At this time, we present a similar study of curriculum bulletins published in 1929-1931. In the course of the discussion we shall introduce related data concerning curriculum collected informally by the authors and others. In a measure this study is a further inventory of the status of the curriculum making movement, as far as it is reflected in the published courses of study of city and state school systems. For each bulletin, we recorded our data on the following blank:

SURVEY OF COURSES OF STUDY

City..... Subject..... Grade..... Critic.....

Note: Underline the answer, or fill in the blank space.

1. Were consultants engaged in the making of the course of study? a) none, b) general consultants, c) subject specialists, d) both.
2. Who was at the head of the program of curriculum revision? a) director of curriculum, b) superintendent, c) assistant superintendent, d) supervisor, e) principal, f) teacher.
3. Does it include an introductory statement? Yes, No.
4. Which of the following does the introductory statement include? a) basic views on education, b) basic views on the subject, c) general objectives of the subject, d) nature of unit of work, e) tests, f) learning equipment and supplies, g) general suggestions to the teacher.
5. Does it include objectives? Yes, No.
6. Are the objectives: a) specific, b) general.
7. Does it tell how objectives were determined? Yes, No.
8. Is the course of study subdivided into parts called units of work? Yes, No.
9. Are they large units or small units? Large, Small.
10. What is the nature of a unit of work: a) complete experience, b) a center of child interest, c) theme or principle, d) graded step or process.
11. Does it include procedures (tell how the activities are carried on)? Yes, No.
12. What is the typographical form? a) parallel columns, b) organized paragraphs, c) organized outlines, d) informal account.

13. Does it include sample tests? Yes, No.
14. How does it provide for adapting instruction to individuals? a) instruction sheets, b) two or three separate procedures, c) levels of difficulty, d) extra assignments, e).....
15. Is there evidence of experimentation before adopting the course of study? Yes, No.
16. Is it a project curriculum (a series of activities without regard to subject boundaries)? Yes, No.
17. Is any research reported on: a) objectives, b) learning studies, c) grade placement, d) curriculum appraisal, e) time allotment, f) individualizing instruction.
18. Is the course of study printed or mimeographed? Printed. Mimeographed.
19. What is the quality of the typography? a) very good, b) good, c) average, d) poor, e) very poor.
20. Does it provide for the use of: a) single textbook, b) list of references, c) both.
21. How many pages does the course of study contain? .....

We analyzed 317 course of study bulletins from 72 school organizations which sent us their publications. All types of school systems are represented in our collection. The distribution of these organizations as to population is shown in Table I.

TABLE I

POPULATION OF CITIES REPRESENTED IN 317 COURSES OF STUDY

Population	Number	Population	Number
Over 250,000	17	10,000 to 25,000	6
100,000 to 250,00	13	Under 10,000	1
50,000 to 100,000	14	State, County, and Territory	17
25,000 to 50,000	4	Total	72

Geographically, the school organizations, whose courses of study we analyzed, represent every part of the United States. They are distributed as follows: New England, 10; Middle Atlantic, 10; East North Central, 15; West North Central, 14; South Atlantic, 7; East South Central, 1; West South Central, 4; Mountain, 2; Pacific, 8; and Territory of Hawaii, 1.

CHARACTER OF THE OUTPUT OF COURSES OF STUDY

Table II shows the distribution of the courses of study among the various subjects and grades. A comparison with our earlier tabulation shows several new tendencies. There was a marked increase in the output of courses of study in commercial education. The appearance of seven bulletins in safety education establishes a new category in our list of courses of study. Seventeen activity curricula are included in the collection we studied which will be discussed later in a separate section.

Classified under the heading of language, three courses in library practice have made their appearance. Not included in our collection of courses of study but reported in a recent survey of curriculum activities of city and state school systems are new bulletins in process in the fields of guidance and character education.

TABLE II

OUTPUT OF COURSES OF STUDY BY SUBJECTS (1929-1931)

	Total, all grades	Primary	Intermediate	Elementary	Total Elementary	Junior High	Senior High	Junior and Senior High	Total Secondary
Activity Curricula*	8	5		2	7	1			1
General Courses of Study	16	1		10	11	2	3		5
Art	15	3		5	8	2	4	1	7
Commercial Subjects	50					11	33	6	50
Foreign Language	21					1	8	12	21
Handwriting	6	1		3	4	1		1	2
Health and Physical Education	25	1	2	11	14	3	6	2	11
Home Economics	10		1	1	2	4	4		8
Industrial Arts	12			4	4	2	1	5	8
Language	38	4	3	17	24	7	6	1	14
Mathematics	26	2	5	7	14	7	4	1	12
Music	10		2	7	9		1		1
Safety Education	6			6	6				
Social Subjects	48	8	14	8	30	10	8		18
Science	26	1	1	5	7	7	12		19
Total	317	26	28	86	140	58	90	29	177

* Nine additional activity curricula are listed under social studies, arithmetic, etc.

As reported in our earlier study the sum of the separate courses in history and geography is greater than the number of social studies courses. This seems to indicate that integration of subjects within the field of the social studies is not proceeding as rapidly as one would expect. This is borne out by an independent study of fifty-seven intermediate history courses of study made by Hannah M. Lindahl[1] covering roughly the same period of time as our study. She found that only four of the fifty-seven courses were fusion courses, in whole or in part. Furthermore, courses of study labeled social studies do not indicate a fusion of history and geography in the majority of the cases.

Besides the commercial subjects referred to above the largest output was in the fields of the social studies, language, mathematics, health, and foreign language. The number of bulletins in secondary education exceeded the number in the elementary grades two years ago as well as in our present inventory. This probably indicates that curriculum making

[1] Lindahl, H. M. "History in the Intermediate Grades," *Elementary School Journal*, December, 1931, pp. 257-265.

in the secondary grades is catching up with the elementary grades which responded to curriculum revision earlier in the decade.

ADMINISTRATIVE ARRANGEMENTS

As the curriculum making movement grows, new and varied experiences in administration are reported. The head of the program, the consultants employed, the special departments created, and the coöperative arrangements with teacher-training institutions differ from place to place. In several cases in which the bulletin is the product of an extensive and elaborately organized program, the organization is set forth in a chart.

The most revealing conclusion from our analysis is the important rôle that the teacher plays in curriculum construction. Not only do teachers serve on most curriculum committees, but in 178 instances they also either headed the project or shared in the leadership with administrative officers. The teacher is the leader in the building of single courses of study more than three times as often as any other school officer and as frequently as all administrative and supervisory officers combined. The principal appears in the rôle of committee chairman only seventeen times which is the least frequent.

Curriculum revision is continuing to make headway not only because it is intrinsically justifiable, but also because it has developed into a most effective instrument of constructive supervision. Thus, a number of school systems have delegated the function of curriculum revision to an assistant superintendent among whose normal duties is that of supervision. Fifty-three of the courses of study analyzed were revised by committees headed by a superintendent; sixteen were headed by an assistant superintendent; and fifty-five were headed by supervisors. It is reasonable to assume that these programs of revision had the function of improving instruction as well as modernizing the courses of study.

In several instances the assistant of the regular and extension departments of nearby universities has been enlisted. The University of Alabama furnished three lecturers and incidental supervisory assistance to the Bessemer, Alabama, Public School program of curriculum revision. The Little Rock, Arkansas, courses of study have been revised with the assistance of the State University Extension Service. The Department of Extension Teaching of the University of North Carolina assists schools in curriculum revision. The Tulsa, Oklahoma, Public Schools have sent groups of teachers to the University of Iowa and to Columbia University

for the express purpose of building new courses of study. The University of Nebraska joined the State Department of Public Instruction in the preparation of a high school curriculum. The construction of the Worcester geography course of study was supervised by the Department of Geography of Clark University. Some of the Indiana state courses of study were prepared by teachers in seminars at the Indiana University. Both the South Dakota and Virginia State Departments organized study programs with printed manuals for several thousand teachers preliminary to curriculum revision.

The director of curriculum was the presiding officer in the revision of thirty-nine courses of study, representing nine school organizations. The following school systems have organized bureaus or departments of curriculum revision since our last survey: Chicago, Ill.; Sacramento, Cal.; Minneapolis, Minn.; Detroit, Mich.; Binghamton, N. Y.; and the South Dakota State Department. In all, there are about a score of school systems which report special bureaus of curriculum revision. In four school organizations, the Bureau of Research was wholly or partially responsible for curriculum revision. These were Hawaii; Cleveland, Ohio; New York, N. Y.; and Lynn, Mass. We reiterate our opinion that if the creation of a separate bureau effects a separation between curriculum construction and the regular supervisory program it is unwise. Supervisory officers should school themselves in the art of curriculum construction and should systematically devote a large part of their time to this work.

Large school systems find it to their advantage to retain general and special consultants to assist them in curriculum revision. Twenty of the courses of study analyzed report the assistance of general consultants; twenty report the assistance of subject specialists; and thirty report the assistance of both general and special consultants. Consultants serve their school systems from several days to several weeks and in some cases follow up their personal conferences by correspondence. Nearly half the school systems represented by the bulletins analyzed engaged consultants for one or more of their courses of study, showing that it is common practice to enlist the coöperation of specialists.

THE INTRODUCTORY STATEMENT OF THE BULLETIN

Ninety percent of the courses of study include an introductory statement which varies in length from two to thirty pages. In 61 percent of the courses of study the general objectives, the broader goals of the subject are given. The basic views underlying the learning of the subject

are given in 50 percent of the bulletins. General suggestions concerning learning procedure are found in 48 percent of the courses of study. The basic views on formal education are set forth in 13 percent of the bulletins. A description or enumeration of the learning equipment and supplies is included in 10 percent of the courses of study. A discussion of the nature of a unit of work is found in 4 percent of the courses of study, although certain implications as to its meaning are to be found in the section devoted to fundamental educational principles. The topics of grade placement, time allotment, adapting instruction to individuals, and the criteria for evaluating units of work are found in a handful of courses of study. Thus the introduction consists mainly of the basic philosophy or theory of the course of study plus certain teaching or learning suggestions.

While it is not always true that the theory as set forth in the introduction and practice as described in the body of the course of study agree, every school system should have a philosophy of education. It is, therefore, surprising that nearly nine-tenths of the courses of study fail to include such a statement. Particularly important is a discussion of the nature of a unit of work or the criteria for evaluating a unit of work. Curriculum workers are groping for an understanding of the nature of the basic learning unit. It would be helpful if those who are dealing with this problem in a practical way would tentatively devote a paragraph to this important element.

Only ten percent of the courses of study discuss equipment, room furnishings, and learning supplies. The physical setting is a factor in determining the learning atmosphere and is fundamental to a life-like activity. Every classroom is a work-room, a laboratory—abundantly stocked with materials—among which printed materials are only element. If this view is to prevail it must get itself written into courses of study.

THE INCLUSION OF OBJECTIVES IN COURSES OF STUDY

The bulk of courses of study includes objectives. Our tabulation shows that 68 percent of the bulletins include objectives. However, only 50 percent of the courses of study included specific objectives. While this is a slight increase over the percent we found in our study two years ago, it still represents a sizeable deficiency in curriculum making. The specific objectives are the pupils' meaningful goals and furnish the direction for the day-by-day activities of the pupils. They show the way out of our present practice in our schools of dispensing knowledge

in tiny capsules. We include in the category of objectives the pupils' self-determined goals found in a small number of courses of study. About 30 percent of the bulletins include general objectives. These are usually found in the introductory portion of the course of study and represent the few broad goals of the subject as a whole. They have only limited value in planning the details of the pupils' daily experiences but they do suggest the more general achievements of the pupils. The courses of study which do not give objectives, and these are 30 percent of the whole number, belong to the antebellum period of curriculum making when a syllabus and a course of study were synonymous.

It would advance the cause of education if every course of study included a brief statement of the procedure whereby the objectives were selected. It is not here proposed that the procedure shall be of an objective rigorous nature nor is it expected of every course of study. It does, however, enable the reader to interpret and evaluate the course of study, and, what is equally important, it is helpful to organizations which are undertaking new programs of curriculum revision. Of 317 courses of study analyzed, only eight or less than 3 percent of the whole number tell how objectives were selected.

UNITS OF WORK

There is no doubt that courses of study are more frequently subdivided into units of work than ever before but there would be considerable difference of opinion as to the frequency depending upon one's conception of the term unit of work. In our analysis, we took the view that a unit was a clearly defined subdivision of a course which had unity or completeness, although its unity may have been based upon any of the following factors: a child or adult experience, a center of child interest, a theme, a principle, a topic, or a graded step. From this viewpoint, 78 percent of the courses were subdivided into units of work. Of these courses of study, 80 percent of the units were based on graded steps or processes such as, *percentage* (arithmetic), *machines* (physics), *circulatory system* (health), *the halogens* (chemistry), etc. This does not represent a radical change in organization or treatment of formal courses but it does definitely annihilate the lesson as the basic unit of a course of study. Eleven percent of the unitary courses of study were based upon a center of child interest, such as, Play City or Trains; nine percent were based on a theme or principle, such *as Transportation* or *Swiss Life*. The latter two groups combined represent a sharp break with the past.

According to Mr. Henry C. Morrison, a unit of work is "a comprehensive and significant aspect of the environment, or of an organized science, capable of being understood rather than capable of merely being memorized."[2] Mr. Herbert B. Bruner says that "a unit is so organized that everything that is included in the way of content, the organization itself, and the method of presenting it to the class is for the purpose of making it possible for the child to grasp the big understanding or theme that is back of it."[3] A unit of work as it is conceived by the staff at the Lincoln School is "a series of worthwhile experiences bound together around some central theme of child interest. Some incident serves as a starting point to arouse such an interest; activities of a compelling nature further stimulate this interest; information from almost every branch of knowledge is drawn upon to answer the questions that arise; individual expression of this interest is encouraged through various media."[4]

It is our view that a unit of work is a complete experience based upon a meaningful situation in child or adult life. The unit is a fusion of mental, emotional, and sensory experience; it proceeds in a physical and social setting that resembles life, as far as possible; and it is directed toward the accomplishment of a goal that results in some improvement in life. More than any of the preceding definitions, ours emphasizes units of human experience, child or adult, as a basis of learning units.

Of the courses of study that contained units of work, 10 percent were large units, that is, those that had a duration of a month or more, and 90 percent were small units. The word unit is an elastic term. According to the conception of Mr. Morrison, Mr. Bruner, and the Lincoln School, discussed above, the unit is large, usually lasting at least six weeks. It is our view that a unit of work is usually relatively small, lasting several days, a week, or several weeks. However, the length of the learning unit depends somewhat upon the related life activity such as, The Care of Pets (elementary science); A Candy Sale (integrated activity); The Roman School: What It Was (Latin); The Literary Magazine (language) and so on. It is our opinion that none of these life

[2] Morrison, H. C. *The Practice of Teaching in the Secondary School.* (Chicago: University of Chicago Press, 1926), p. 182.

[3] Bruner, H. B. *The Place of Units in Course of Study Construction.* Bulletin No. 2. (Pierre, South Dakota: State Department of Public Instruction, 1930), p. 10.

[4] Keelor, K. L., and Sweet, M. *Indian Life and Dutch Colonial Settlement.* (New York: Bureau of Publications, Teachers College, Columbia University, 1931), p. 2.

activities requires an especially protracted learning unit. The objection to long units is that unless they are broken up into smaller pieces, they encourage digressions. They do not help the pupil and the teacher to mark definite points of progress in learning. Psychologically, they do not furnish the stimulation that comes from the awareness that one is making headway.

THE FORM OF THE UNIT OF WORK

According to form the unit of work is presented in four ways: 1) in outline under several headings; 2) in parallel columns under several headings; 3) in solid paragraphs under several headings; 4) in informal description. An analysis of our collection of courses of study revealed that 48 percent were in the form of organized outlines; 26 percent were in the form of solid paragraphs; 16 percent were in the form of parallel columns; and 10 percent were in the form of informal description. Table III shows a comparison of form in this survey with the one we made two years ago.

TABLE III

COMPARISON OF FORM OF UNITS 1930 AND 1932

	Percent of Total	
	1930 242 Courses of Study	1932 317 Courses of Study
1. Organized Outline	47	48
2. Parallel Columns	27	16
3. Solid Paragraphs	19	26
4. Informal Description	7	10

The organized outline seems to persist in being the common form although, in our opinion, it encourages vagueness and carelessness of expression and it gives the page a broken and irregular appearance. It is gratifying to record that the *parallel column form* is becoming less common, not only because it is hideous to look at but also because it is a stupid waste of space. The increase in bulletins in the form of solid paragraphs and informal accounts represents a distinct gain because they are clearest and fullest; they make the most attractive printed page; and they conform to one's normal reading habits.

THE INCLUSION OF TESTS

Despite the voluminous output of printed tests and manuals on test construction we are of the opinion that we are still in the primitive stage of test making for learning or curricular purposes. The primary purpose of the test is to determine whether the goals of a unit or a

block of units have been achieved. Fifty-seven or 18 percent of the courses of study included tests of some kind, which is ten percent more than were found in courses of study two years ago. These tests are largely of the new or objective type. They do not test for expression and creative ability; they do not test for the ability to organize parts into a coherent product; they test for reasoning only to a limited degree; they do not test for the ability to apply facts, skills, or generalizations; they do not test for the accomplishment of child or adult objectives. Beyond the basic discovery of the brief answer and objective scoring, ingenuity in test making has run out. It is of fundamental importance that the test should be based on the objectives of the given course and that the test items should elicit life-like responses.

ADAPTING INSTRUCTION TO INDIVIDUALS

There is an increasing tendency to include suggested methods of adapting instruction to individuals. Whereas only nine courses of study made provision for individual differences in our study of 1929, the percent rose to twenty-one in our present study. Twenty courses of study suggested two or three procedures for ability groups in parallel columns or in successive paragraphs. Twenty-four courses of study included extra assignments for brighter pupils.

Only two courses of study were in the form of individualized self-instruction sheets or work books. However, these materials are probably widely used in the form of published work books. Twenty-four courses of study made certain miscellaneous provisions such as suggested omissions, suggested variation in rate for backward pupils, suggested extra drill for dull pupils, suggested emphasis on more important parts, and the suggested use of concrete materials. Nearly all the activity curricula, owing to their flexibility, the opportunity for pupil initiative, and the common subdivision of the labor in a project, provide for a considerable amount of individualization. The individualization of learning is in a more plastic form now than it has ever been and schools which report successful experience in their course of study bulletins by that means may contribute to progress in this matter.

To be Continued

EDITORIALS

A MATTER OF HUMAN NECESSITY

Emerson expressed a part truth in the couplet—

"From Jove, Prometheus stole his fire
And, without Jove, the good had never been."

HISTORY emphasizes the reverse fact that without a Benjamin Franklin or another usefully minded doctor the good of science had been little realized.

The above is intended to recall to our older readers the answer given by the *Journal of Educational Research* in its first issue (January, 1920), and many times reiterated since then, that educational research, particularly, can realize the good by making, and then fitting, its discoveries to ways of improving school work.

Exceedingly important as the findings of laboratory research are, its generalizations are frequently true only for the controlled conditions of the laboratory. School research has, under the necessity of the situations, the specific task of discovering relationships true of the less well controlled conditions of the classroom.

The vital issue involved in an educational service to field workers is one of means to an end. Will a research service be most effectively rendered by means of a pouring in process of merely supplying information or by the stimulation of the field workers to see and solve problems? Without wholly sacrificing the first of these services, the *Journal of Educational Research* aims at the latter believing that the greatest service will be rendered to field workers when teachers, supervisors, principals, and superintendents are stimulated to the solution of their own problems. It is believed that teachers will be happier and more efficient in the practice of education when supervisors substitute, for the now commonly pursued policy of memoriter textbook training of teachers, a method of problem solving.

An adequate answer to the question: "Can a research publication be at the same time scientific, practical and readable?" involves more definition of terms than the writer can here attempt. In answer to the question can practical research be scientific, it may be urged that to say that a research is practical is no excuse for poor research. Good research involves definition, objective measurement, and the recognition of factors even when those factors cannot be controlled. And finally it may be urged that the fact that the reporting of a piece of research involves a certain technical vocabulary is no excuse for poor expression. The difficulties most frequently experienced by lay workers in the reading

of technical reports are not technical difficulties but the difficulties of hazy thinking and inadequate expression.

In pursuit of the afore-described policy, the *Journal of Educational Research* wishes to emphasize articles which are directive in character, utilizing completed research and studies under way to illustrate techniques and suggesting needed investigations. To this end the *Journal* shall publish:

(1) reports of individual researches offering tentative solutions to specific educational problems, and enumerating carefully defined problems for further research; also articles suggesting the techniques of research appropriate to these researches; and

(2) critical reviews of previous investigations carefully differentiating between fact and fancy and indicating, as in the aforenamed articles, issues and techniques for further research. In the pursuit of this policy the *Journal of Educational Research* will put primary emphasis upon the instructional activities of the school system.

Believing that a scientific publication should be neither conservative, professional, nor radical, the *Journal* desires to publish experimental studies of all of the better developed hypotheses of education. Feeling, however, that it is at this time somewhat more difficult to secure carefully controlled studies of the less formal aspects of education, the *Journal* desires to give particular attention to this human side of the school program, the "whole" child, and the newer theories of education. The whole hearted coöperation of both the producers and consumers of research is invited in this project.

A. S. Barr

CHANGES IN OUR EDITORIAL STAFF

The additions made to the directive editorial board indicate the willingness of specialists in the different phases of the schools' problems to give time and energy to assist those who must solve, as best they may, the immediate difficulties in all divisions of school work. The five new workers on the editorial board represent five distinct lines of investigation of the school situation now being carried on.

Harry J. Baker, director of the psychological clinic in the Detroit public schools, is a leader among students of the possibilities in the school situation. He is concerned for child welfare at every step in the educational process.

Leo J. Brueckner, professor of education at the University of Minnesota, is a leading student and an active contributor in the field of elementary school work. He is active in the search for better adjustments of instructional situations to learning requirements.

Ernest Horn, director of the university elementary school and professor of education at the State University of Iowa, has coöperated as a leader in work of many investigations during the last twenty years concerned with curriculum construction and the objectives for different types of school work. His leadership in this work is due to very detailed knowledge of its many phases.

Charles W. Knudsen, professor of education in George Peabody College, is a specialist in the present problems of school supervision and of the psychology of learning. He has just returned from a year of study and investigation of school conditions in Europe.

Clifford Woody, director of the bureau of educational reference and research and professor of education in the University of Michigan, has been associated with the *Journal* since its organization. No director of research has kept in closer touch with the actual use of research methods in the public schools themselves.

Our present active board of editors (Barr, Ashbaugh, Good, Baker, Brueckner, Horn, Knudsen, and Woody) and the widely distributed list of associate editors, are shock troops for the present critical situation. The public generally is demanding to know what educational results can be shown to be worth what they cost. Can better results be realized if present defects are remedied? A vital question is; Are schools trying to do more things than should be delegated to them, things that could be done better by homes or communities?

A RESEARCH OPPORTUNITY IN OUTLINE

The school is a great research opportunity, taken as a phase of the organic growth and of the social integration of child life on its way toward mature fellowship in an advancing civilization. Not only must the school as it is, be analyzed but also the possibilities of better nurture, and of more complete realization of results must be brought together and, by experiment, organized for realization.

A natural situation from which to gather the facts of organic growth in power to learn, and of society's efforts to determine school education here in America, is found in the experiences of our independent settlers and in their continued effort to advance school education to meet the needs of democratic citizenship. A citizenry independent of foreign autocratic control, ready to clear their own lands and build their own communities, towns and states, yet appreciative of social organization of and by and for all, sought to school their children so that they would be free from the bonds of ignorance, and also active as members of an advancing civilization; each one bound to the purpose of doing his part to advance the common good. They sought an education to advance the abilities and the social possibilities of a democratic people. They did not plan schools to teach any doctrine of government. Education was to provide a common body of knowledge for everyday life, and to enable every one to think from given conditions to independent conclusions. This is an ideal situation for real research as to what the school is to-day compared to earlier days, and for the discovery of trends indicating what the school may be.

What the school may be is limited by the opportunities of instruction to organize and apply the principles for the nurture of ideas, and for the organization of ideas in the processes of thinking. It is limited also by the opportunities to bring into play social and mental experiences as

incentives stimulating the processes of learning through personal associations for group ends.

This last limitation is also an imperative, since the progress of civilization must always depend upon the progress of a genuine socialization of its individuals. Isolated personalities, trained or untrained, nullify the permanent advance of society as a whole. The school must do its part to aid the community and society to initiate the young into fellowship and citizenship by developing integrity of character in all fellowship relations and by securing a recognition of the necessity that the acts of each personality be directed toward the welfare of society. This is an essential quality of education in a democracy.

The American school is tending, though with the apparently blind efforts of a natural evolution, toward this union between the individual and the social requirements necessary to bring every person under the common classification of the gentleman, the true citizen of a democracy. Educational research is now active in the analysis of the powers and energies at work in the classroom and for the broader organization of school opportunities. This analysis determines for each activity the nature of the abilities involved in organizing the activity for learning or experience. To some extent research is analyzing the possibility of selecting and adapting the activities of the curriculum beginning with those more direct and simple relations which can be followed by younger and less developed minds, and advancing easily to the more complex and less direct relations of the ideas required for full knowledge and use.

Much research is needed in this field of adapting subject matter to growing abilities (mental age). Abilities do not come into action full fledged. Involved with the ability to carry on a study is the opportunity to acquire the mental skills for consciously bringing together the known ideas and fitting them with new ideas to extend the organization of knowledge and develop new skills. Ability needs mental skills and uses them to organize further abilities and to develop other skills. This is the process of learning to understand and use the succession of subject matter ideas to secure a knowledge of them in usable form.

To gain skill in applying this knowledge in other connections of thought is another learning process, and is related directly to the second limitation of the school, that of its opportunities to bring into play social as well as mental experiences. Mastery of at least unit bodies of knowledge is necessary to the use of skill in applying knowledge to life.

It is evident, from the close relation of the research concerned with what the school may be to the actual school condition under which teachers and pupils work, that much of the final experimental study of the principles and practice for better means of instruction needs to be carried on in coöperation with supervisors and teachers. To make the relationship more effective the *Journal of Educational Research* undertakes to be a medium for the exchange of experiences, and where possible for direct service in the work the schools do to determine improved practice.

REVIEWS

Address all communications relative to book reviews to Editor E. J. Ashbaugh, Miami University, Oxford, Ohio.

UMSTATTD, JAMES G. *Student Self-Support at the University of Minnesota.* Minneapolis: The University of Minnesota Press, 1932. xii + 205 pp.

On most college campuses the development of agencies concerned with the part-time earnings of students has been rather casual. The University of Minnesota appears to have been, until within recent years, no exception.

Professor Umstattd's study concerns itself with a local situation, but the methods used and the conclusions reached should be of interest to those persons who are giving thought to the student who of necessity or by choice is partially or wholly self-supporting.

The extent and nature of self-support, its influence on scholarship, on other extra-curricular activities and upon health as well as the attitudes of students toward it are among the topics discussed. The author is able to demonstrate a fact hitherto only suspected, namely, that students generally do not earn in proportion to economic need. Many institutions have as a matter of principle insisted that self-supporting students carry a reduced scholastic load. This study would indicate that such action is ordinarily justified only when an excessive proportion of self-support is undertaken by the student.

The chapter on collection and treatment of data is, for the ordinary reader, unnecessarily detailed but would be of interest to those thoroughly familiar with the University of Minnesota organizational relationships. Not the least contribution of this study is the list of suggested problems for further study contained in an appendix.

JOSEPH A. PARK
Ohio State University

GRAY, H. A. *Some Factors in the Undergraduate Careers of Young College Students.* Teachers College, Columbia University Contributions to Education No. 437, 1930. iv + 66 pp.

Through the analysis of the records of one hundred twenty-six boys at Columbia and twenty-eight girls at Barnard, all of whom had entered college under sixteen years of age, the author has attempted to isolate the factors most influential in their undergraduate achievements and experiences. His objectives are (1) "To test the necessity for, and the desirability of, minimum age requirements for college entrance," and (2) "to set up admission criteria . . . . . which will better enable college officers to decide the question of admission of the individual applicant whose chronological age is obviously less than that of his prospective classmates."

Unfortunately, the subjects chosen for this investigation were far from representative of the young college students in America. They were, for the most part, children of Russian Jews of relatively high educational and occupational status. Three-fourths of the group lived at home while attending college. Furthermore, Columbia College includes in its

entrance requirements the provision that the applicant be at least sixteen years of age, a requirement which "is usually waived, if, after a personal interview given each prospective freshman, the candidate gives the impression of being *socially and mentally mature* . . . . ." The intelligence of the group as measured by the Thorndike Intelligence Examination is high, 86 percent of the group exceeding the mean of the student body of the two colleges.

Under such conditions it is hardly surprising that in scholastic achievement, as measured by grade points, academic honors, time required for graduation, and by percentage of the group receiving degrees, these young students surpass by far the general average of the student body.

Comparison with a control group indicates that participation in extra-curricular activities, both athletic and non-athletic, is as extensive for these young people as for the student body in general. The author's statement that "the young boys won more laurels in athletic participation" cannot be taken seriously, when a tabulation reveals two letters awarded the young boys against one in the control group.

Comparison of the two groups on emotional factors shows no evidence of unusual difficulties among the young. The author recognizes the limitations of this part of his study, based on data from a questionnaire submitted to the subjects after graduation.

Health records reveal little difference between the young group and the controls.

The peculiar selection of subjects definitely limits the general significance of the results for college admission regulations. The records of this select group, however, must be taken as evidence that students three years younger than average, despite their early entrance, may, if they possess other requisites, compare favorably with their older classmates.

F. H. FINCH
University of Minnesota

KNUDSEN, CHARLES W. *Evaluation and Improvement of Teaching.* Garden City, New York: Doubleday, Doran & Company, Inc., 1932. x + 538 pp.

This book is very much like the others in this teacher training series in its organization and its philosophy. Whether this is an asset or a liability will depend upon the attitude and training of the reader.

The material used in the book is based on the contents of a graduate course of the same name taught by the author at the George Peabody College for Teachers. As a consequence, the thought and style of the book are those which one would use on the graduate level. The occasional long sentences do not help any in making the book more readable.

The conception of teaching in the secondary school that the author attempts to evaluate and improve is a limited one, for his discussion deals only with the knowledge and drill outcomes of teaching. Further, it is based on the assignment and lesson-learning type of work. These limitations will seem very important to those who believe in encouraging pupil development through self-direction and who think there are important objectives that cannot be classified as skills and knowledge.

The reader who goes to the book without expecting to find a complete discussion will find much of value on its pages. It is well written and carefully edited. Further, it presents an attractive appearance. Many helpful suggestions are included and many scientific studies are drawn upon to furnish material to justify the conclusions.

Controversial matters, however, are not always discussed from all points of view and the reader will be forced to discriminate at times. For example, the author spends some time showing the technique that one might use in evaluating teaching methods by means of standardized tests at the close of the year or semester, but he neglects to discuss how one may improve teaching by a testing program at the beginning of the school year. Many administrators know how helpful a program of tests is whose purpose is to aid teachers to find out what needs to be done. They also know how futile it is to try to rate teachers by means of a testing program at the end of the school year. Any extensive use of tests in the secondary school which has for its purpose the evaluation of teaching is almost sure to dominate the activities of some of the teachers until they do little but coach for the tests.

CHARLES E. HOLLEY
University of Idaho

ANDERSON, C. J., AND SIMPSON, I. JEWELL. *The Supervision of Rural Schools*. New York: D. Appleton & Company, 1932. xiii + 467 pp.

This is not merely another book on the principles and methods of elementary supervision, but rather it is an excellent contribution to the important field of specialized problems relating to the supervision of rural schools. Out of their rich background of experience and intimate contact with progressive practices in rural supervision, the authors have brought together a graphic picture of conditions, practices and seasoned criticisms of the whole problem of rural school supervision that is professionally stimulating and helpful to read.

Part I introduces the problems of the rural school situation and the peculiar needs of supervisory effort together with a brief historical account and evaluation of the various schemes now being practiced.

Part II treats with fine objectivity and clearness of vision the prerequisites for effective rural school supervision under the topics—planning supervisory programs, budgeting the time of the supervisor, and workable daily schedule for small schools.

Part III presents the factual bases for supervisory procedures, namely, objective tests and measurements, and supervisory visits to the classroom.

Part IV offers much of practical value in promoting the professional growth of teachers through individual conferences, purposeful group meetings to meet teacher needs, demonstration lessons, supervisory bulletins, making and interpreting the course of study coöperatively with teachers, and the rejuvenation of the county institute.

Part V gives an unbiased appraisal of the value of supervision in rural schools and indicates needed research in the many unsolved problems yet remaining in the field.

There is evident throughout the volume a sound philosophy of education, a modern scientific approach to the problems presented, and a skillful presentation of practical suggestions to make effective modern principles of education in rural schools. It is an exceedingly valuable contribution to a much needed phase of the problems of rural education.

H. L. TURNER
Michigan State Normal College

CURETON, EDWARD E., AND DUNLAP, JACK W. *The C-D Machine Correlation Chart*. New York: The Macmillan Company, February, 1932. Twenty-five charts, padded, 10¾ x 16⅝ inches, for $1.00.

The latest addition to the growing family of correlation charts contains a desir-

able number, 23 x 23 of plotting compartments in a plotting space approximately $8\frac{3}{16}$ inches square. Its chief claim to merit over its dozen or more progenitors lies in the use of alternate diagonal rows of colored compartments for facilitating the counting of diagonal frequencies. This advantage, however, is largely offset by the need, according to the method employed, of counting diagonal frequencies twice, and the astigmatism-producing tendency of the checkerboard pattern in plotting. Its appellation of "machine" doubtless comes about by reason of the fact that no provision is made for recording hand-made extensions and that the direction sheet gives directions for making the extensions on the calculating machine. Only a portion of the formulæ employed are in most convenient form for calculating machine computation. And, although, according to the authors, the chart "provides checks on all the important arithmetical work" no hints are given as to the method of locating the errors which are inevitable even in the case of the most experienced computer. The novitiate will find the abbreviated directions difficult if not impossible to follow. With one fold the charts will file conveniently in an $8\frac{1}{2}$ x 11 file folder.

HERBERT A. TOOPS
Ohio State University

ALEXANDER, CARTER. *Educational Finance Studies.* New York: Teachers College, Columbia University, 1931. vi + 92 pp.

This work is devoted to a description of nineteen recently printed dissertations at Teachers College. In the foreword, the author makes the following statement:

"No attempt is made to summarize a study so that any administrator interested in its special problem will not need to read the original. The treatment here aims to help him ascertain *when* he needs to read the original. Possibly this is the greatest service such a volume could render."

The dissertations are described under the following three headings: (1) Fiscal Procedures of Importance in Educational Finance, (2) School Costs, and (3) State Aid for Schools, five of the dissertations coming in the first division, five in the second, and nine in the third. Frankly, the reviewer can see little professional value in the volume. Of the nineteen descriptions offered, only a few are adequate enough to achieve the purpose stated in the foreword. Some of the descriptions would serve very well as reviews for some magazines, and all of them would make excellent copy for a sales promotion program for the dissertations. In order that the reader of this review may have an illustration of what has been done, the last page of the book is presented here:

CAPITAL OUTLAY IN RELATION TO A STATE'S MINIMUM PROGRAM*

The Problem

"To find a technique which will enable a state to equalize the burden for capital outlay purposes" for public schools.

Sources of Data

New Jersey state statistics for 1919 to 1928 and the literature of the subject furnished the data.

Methods Employed

Highly statistical methods were employed, but the chief results can be followed by any interested schoolman.

Important Findings and Recommendations

1. A technique which will enable any state to equalize the burden for capital outlay for schools, through the relationship of debt service to current expense.
2. The best available discussion of the wisdom of so equalizing such outlays.

Evaluation

1. No state ought to enter upon state aid for school buildings, or to expand or

reorganize its system of such aid, without mastery of Dr. Grossnickle's findings and recommendations.

2. On this basis, educational leaders and others interested in state aid for rural schools should have the book.

* By Foster E. Grossnickle, Ph.D. Teachers College, Columbia University, Contributions to Education, No. 464, 1931.

The volume does not reflect the high quality of work which has usually come from the pen of Carter Alexander.

JOHN GUY FOWLKES
University of Wisconsin

EBAUGH, CAMERON DUNCAN. *The National System of Education in Mexico.* Baltimore: The Johns Hopkins Press. The Johns Hopkins University Studies in Education, No. 16, 1931. ix+149 pp.

The major part of this study is devoted to a description and evaluation of the national system of education in Mexico since the "reform of 1921." Introductory to the major discussion the author considers briefly the geographical and social conditions of Mexico, recalls certain facts of Mexican history, and describes educational conditions prior to the decade under special consideration. The descriptive data in the main discussion are drawn largely from publications of the Secretariat of Education. Separate chapters are devoted to the department of rural schools, the primary and normal department, federal secondary schools, the National University of Mexico, the department of fine arts, the department of psychopedagogy and hygiene, the department of school libraries, and "other activities of the Federal Department of Education." The two concluding chapters are devoted to a "synthesis" and "conclusions," respectively.

The book contains a great deal of information which educators in this country should know. There is no doubt that profound social changes are under way south of the Rio Grande. Educational and other social experimentation is being conducted on a gigantic scale. It is clear, too, that we have much to learn from this experimentation—not simply by way of understanding and appreciating a neighboring people, but by way of adding to our knowledge of the educative process as a means for advancing social welfare.

If Dr. Ebaugh's recital of facts on the purposes and activities of the federal government in Mexico is supplemented by other sources which will supply details and incidents, the reader is sure to be fired with admiration and enthusiasm. Take the village school as an example, and reflect on the intimate relation of the school to the life of the community. Perhaps the very building has been built, not by the cold method of a bond issue, but by the personal labor of the men of the village. Or consider the cultural mission as it moves into a community with its various specialists, and see how its teaching grows directly out of the community life. Problems of hygiene, housing, industry, and farming are not found in a textbook based on "real-life" situations; they come from actual grappling with conditions near at hand. While others are busy with their specialities, the teacher of music gathers together those who can play this or that to form a community orchestra or band.

Without discounting in the least the great progress already made, one is left with the feeling that the book is, in many respects, a description of aims and plans rather than accomplishment. The description would have been strengthened enormously by a first-hand survey of conditions and a detailed account of typical situations.

The evaluation, too, does not seem convincing. The method seems largely that

brief appeal to the writings of Kandel, Bode, Dewey, and others, with an attempt to show that the system conforms to the principles expressed by these educators. The praise is so lavish as to leave the impression that the author has probably not been as critical as he might have been.

However, in making available in English an account of the organization and plans of the national system of education in Mexico, Dr. Ebaugh has made a valuable contribution to educational literature. The book should be widely read.

H. T. MANUEL

University of Texas

COOK, W. W. *The Measurement of General Spelling Ability Involving Controlled Comparisons Between Techniques.* University of Iowa, Studies in Education, VI, No. 6. February 15, 1932.

The construction of standardized and semi-standardized tests has assumed a place of increasing importance in educational circles during the past decade. In such a growing field it is likely that questionable procedures for test construction and evaluation will find a ready acceptance because the makers of tests either have insufficient knowledge or fail to assume a critical attitude.

In a recent experimental study by Dr. Cook, certain problems of test construction have been given consideration. A very satisfactory theoretical discussion of the need for a critical evaluation of procedures in the development of testing techniques and experiments is presented. This theoretical discussion is followed by a very adequate and comprehensive series of experiments measuring the results of spelling. The study deals with three major problems: first, the selection of test items with regard to difficulty and discriminating power; second, the selection of a test technique for presenting the items; and, third, the determination of the optimum number of items to be included in a test which is to be administered in a given length of time.

Experimenters in the past have quite generally neglected the problem of administration time of a test. The author conducts an experiment showing that the working time allowed pupils in the administration of a test is an important factor in the validity of that test. He then establishes what he terms the *optimum* testing time for each of his six self-administering spelling tests.

The author was very judicious in selecting the field of spelling where results can be measured objectively, and where certain experimentation relative to the difficulty of items has already been carried on. Some of the criticisms which are pertinent to spelling tests may also be applicable to other fields, such as, social science. Unfortunately, we are unable as yet to apply the results of experimentation to the social science field in the same way as in the field of spelling. On the whole, this contribution is a very worthy addition to the literature of test evaluation and test construction. The implications of the study should be given careful consideration by those who are attempting to construct and evaluate tests.

VICTOR H. KELLEY

Arizona State Teachers College

MORRISON, HENRY C. *The Management of the School Money.* Chicago: The University of Chicago Press, 1932. pp. xx + 522.

The author is well known in the field of public school finance and needs no introduction. His views on matters of economy in the administration of the schools have been published in preceding volumes. The appearance of this book, which goes deeper into the details of the

practical realization of these ideas, was not unexpected.

Most people who read the book will probably have the feeling that the title does not do justice to its scope. Public school business management is vitally concerned with the whole range of educational planning and is so treated in this book.

The author leaves no room for doubt concerning his strong preference for reserve funds, both capital and contingency. He admits that there exists wide differences in opinion concerning the desirability of reserve funds, but presents arguments to support the position he has taken. It is certain that his proposals on this matter will meet with stubborn opposition from those who maintain that our experience with reserve funds in the past has condemned them as not desirable.

The proponents of the pay-as-you-go policy for financing buildings and equipment will find their position supported in this book. The strongest opposition to such a policy comes from its application to small communities where its practice necessitates building up reserve funds. Since reserve funds hold no horror for the author, he advocates that the pay-as-you-go policy in financing school buildings and equipment be adopted in even the small communities and maintains that it is the only sound policy from a financial standpoint.

In accounting the budgetary matters, he would not tolerate looseness or neglect. On this proposal, he will have almost unanimous support. However, one must feel regret over his failure to recognize the virtues of the Uniform School Accounting System adopted a few years ago by the National Association of Public School Business Officials and which has been increasingly employed in the United States.

One striking feature of the work is the definition of terms used and the many illustrations of correct and incorrect usage. Any successful effort to clarify concepts and secure better usage of terms in this field is to be commended.

One of the chapters presents a very adequate treatment of terminal costs, a subject on which too much has not been written. Attention is given to the concept of terminal costs, their place in business management of the schools, and methods of computation. This is probably the most complete treatment in print of terminal costs as applied to public school finance and is, therefore, to be considered a distinct contribution.

Several formulæ are presented which have not previously received wide publicity. These include such matters as adjusted depreciation of buildings, building reserve required on account of increased enrollment, and when to sell an old building and site and move elsewhere. Several new terms are introduced, a conspicuous example of which is "coefficient of effective use" for what has been known as "percentage of building utilization."

A great deal of attention is given to the economic foundation on which the public school system rests. The thesis is that schools must return to the economic fabric of society an amount equal to their cost or they cannot continue to exist. He believes that our schools meet this requirement and cites instances of how it is done. He further believes that there still exists a great deal of waste and inefficiency which can be largely eliminated by a high type of professional education for the public school administrator.

This book may well be taken as a valuable addition to the new but growing field of publications primarily concerned with a more desirable type of administration of the business affairs of our public schools.

GARTH H. AKRIDGE
Columbia University

RESEARCH ABSTRACTS and BIBLIOGRAPHIES

Address all communications relative to research abstracts and bibliographies to Editor A. S. Barr, University of Wisconsin, Madison, Wisconsin.

EDUCATIONAL ADMINISTRATION AND SUPERVISION

WILDS, ELMER H. "Interschool Contests in American High Schools," *School Review*, XL (June, 1932), pp. 429-441.

From a questionnaire study of interschool contests in American high schools the author concludes that an extensive variety of interschool contests are carried on. Practically all these types of competition have developed in the high schools during the past quarter of a century.

WILLIAMS, LEWIS W. "Turnover Among High-School Teachers in Illinois," *The School Review*, XL (June, 1932), pp. 416-428.

A study of turnover among high-school teachers in Illinois for a ten-year period from 1921 to 1931.

EXPERIMENTAL STUDIES OF LEARNING AND TEACHING

BOWMAN, HERBERT L. "A Technique for Determining the Relationship between Reported Preference and Performance," *Journal of Applied Psychology*, XVI (June, 1932), pp. 288-297.

From the use of two tests of twenty-five problems, each on the subject of arithmetic, administered to 564 seventh, eighth, and ninth grade pupils that concludes that reported preference within a narrow field can be measured with a remarkable degree of accuracy by employing definite reporting methods in narrowed-down preference situations. A correlation of .56 was found between preference and performance.

BURKERSRODE, JOHANNES, UND BURKHARDT, FRIEDRICH. "Die Lesbarkeit der Gross—und der Kleinschreibung," *Padagogisch-Psychologische Arbeiten aus dem Institut des Leipziger Lehrervereins*, XIX (1932), pp. 1-3.

Legibility of capitals and small letters in spelling. The result of a number of experiments has proved that spelling without capital letters is superior in legibility. (E. P. Appelt, University of Wisconsin).

CALDWELL, OTIS W., AND LUNDEEN, GERHARD E. "What Can be Done Regarding Unfounded Beliefs?" *School and Society*, XV (May 14, 1932), pp. 680-686.

The object of this investigation was to secure objective data which would indicate whether knowledge and attitude, with regard to unfounded beliefs, may be changed by special instruction. The mean gain in achievement score in desirable responses following the instruction was 33.3 percent.

FREEMAN, FRANK N. "An Experiment in the Use of Typewriters in the Elementary School," *Elementary School Journal*, XXXII (June, 1932), pp. 752-759.

From an experimental study of the use of typewriters in the elementary school it was found that the use of the typewriter does not cause a deterioration in either the speed or the quality of handwriting, and the experimental group showed a superiority on two achievement tests of about 7 percent of a grade unit of progress for the first year.

HOKE, REX L. "Factors Conditioning Efficiency in a Motor Skill," *Journal of Experimental Psychology*, XV (June, 1932), pp. 316-330.

An experimental study of motor learning from which the author concludes that the mental factor of fear of punishment and recognition of the exact result of the attempt are significant factors in the execution of a skillful act. The author found that attention on the idea of success, punishment only for gross errors, attention on the goal, and attention to accompanying sensations were factors of doubtful value.

MCGEOCH, JOHN A. "Forgetting and the Law of Disuse," *Psychological Review*, XXXIX, (July, 1932), pp. 352-370.

Evidence is presented to show that the law of disuse does not account for forgetting. The hypothesis is advanced that the necessary conditions for forgetting are interpolated activities and altered stimulating conditions. Disuse is important only in that it so often gives the primary conditions an opportunity to act.

PRESSEY, L. C., AND MOORE, W. S. "The Growth of Mathematical Vocabulary from the Third Grade Through High School," *School Review*, XL (June, 1932), pp. 449-454.

The authors conclude that inadequate mastery of fundamental terminology is one of the most important reasons for the difficulty encountered by so many persons of all ages and social strata in dealing with anything of a mathematical nature.

RENWICK, E. M. "Children's Misconceptions Concerning the Symbols for Mathematical Equality," *British Journal of Educational Psychology*, II (June, 1932), pp. 173-183.

From a study of children's misconceptions concerning the symbols for mathematical equality the author concludes that there are many ten to twelve year old children who find unintelligible a statement that one numerical expression is equal to another. This appears to be due to the fact that their early training in arithmetic leads them to look upon any symbol of operation as an imperative, and this prevents them from conceiving a numerical expression as a unity.

THISTED, M. N., AND REMMERS, H. H. "The Effect of Temporal Set on Learning," *Journal of Applied Psychology*, XVI (June, 1932), pp. 257-268.

From an experimental study of the effect of three different time sets on the learning of 404 students of elementary psychology the author concludes that the data tend to establish a somewhat slower drop in the forgetting cure when a temporal set is introduced.

TINKER, MILES A. "The Relation of Speed to Comprehension in Reading," *School and Society*, XXXVI (July 30, 1932), pp. 158-160.

From a review of previous investigations relating to speed and comprehension in reading, the author concludes that there is a close relationship between speed and comprehension.

CURRICULUM RESEARCH

GUILER, WALTER SCRIBNER. "Difficulties Encountered by High-School Graduates in the Use of Verbs," *School Review*, XL (June, 1932), pp. 455-459.

From an analysis of the test papers of 625 high-school graduates who were given the Guiler-Henry Preliminary Diagnostic Test in Grammatical Usage the author offers an analysis of difficulties encountered by high-school graduates in the use of verbs.

RODEAN, WILLIAM A. "Overlapping of Content in Textbooks in General Science and Biology," *School Science and Mathematics*, XXXII (June, 1932), pp. 605-613.

The author presents a statistical analysis of the content of certain textbooks in general science and biology. The author finds that over thirty-seven percent of the textual material in general science is repeated in biology, and fifty-six percent of the materials in biology is given in general science. He concludes that overlapping does not necessarily constitute a waste of time.

SCHLOTTE, DORA. "Beobachtungen uber den Buchwunsch des jugendlichen Leser," *Padagogisch-Psychologische Arbeiten aus dem Institut des Leipziger Lehrervereins*, XIX (1932), pp. 51-54.

Observations concerning selection of books of juvenile readers. The main goal of the investigation was to find out what development the literary interests of children who frequent libraries takes. Children between 9 and 10 years ask for picture books. After this age they select fairy tales, legends, fables, funny stories, in the order given. Adventure stories are wanted by boys between 11 and 13, by girls between 12 and 13. Boys between 13 and 14 take greater interest in geographical books than girls. Their next selection is books dealing with natural sciences. After the age of 13 interest for history is increased both by boys and girls. Wishes for particular books are stimulated in the greatest number of cases by school mates. Parents have no great influence. Books were favorably criticized when the reader likes (1) subject matter, the characters and their fates, the dominating mood or some isolated fact, (2) language and style, (3) binding and illustrations, (4) when the book had some relation to their own experiences. The investigation comes to the conclusion that children beginning at the age of 10 are able to judge their readings in regard to content and presentation. (E. A. Appelt, University of Wisconsin.)

WEBB, HANOR A. "The High School Science Library for 1931-32," *Peabody Journal of Education*, X (July, 1932), pp. 20-32.

The author presents in this article his annual list of newest books in the field of junior and senior high-school science.

MEASUREMENTS, STATISTICS, AND SCIENTIFIC TECHNIQUES

COURTIS, S. A. "Criteria for Determining Equality of Groups," *School and Society*, XXXV (June 25, 1932), pp. 874-878.

The author discusses the inadequacy of current methods of equating groups, and suggests that matching must be based upon achievement and growth. He offers five criteria for the equating of groups in school experimentation.

FRYER, DOUGLAS. "Validating Measures of Interest: With Particular Refer-

ence to Group Interest Scales," *The Personnel Journal*, XI (August, 1932), pp. 103-110.

A discussion of five methods of validating tests of interests.

WATSON, GOODWIN B. "Character Tests and Their Applications Through 1930," *Review of Educational Research*, II (June, 1932). pp. 185-257.

Contains a summary of researches relating to character tests and their application through 1930. Bibliography.

MISCELLANEOUS

BURKERSRODE, JOHANNES. "Ermudung bei diaskopischer und episkopischer Projektion" (Fatigue through the use of projectoscopes and stereopticons) *Padagogisch-Psychologische Arbeiten aus dem Institut des Leipziger Lehrervereins*. Volume XVIII (1930), pp. 49-92.

Fatigue by using projectoscopes is greater to spectators if they are sitting close to the screen; when the stereopticon is used, fatigue is greater if spectators are sitting closer to the apparatus. (E. P. Appelt, University of Wisconsin)

BUSWELL, GUY THOMAS. "Summary of Arithmetic Investigations (1931)," *Elementary School Journal*, XXXII (June, 1932), pp. 766-773.

An annotated bibliography of investigations relating to the subject of arithmetic for 1931.

SCHLOTTE, FELIX. "Ausschuss fur Begabungsuntersuchungen: Vergleichende Begabungsuntersuchung an Haupt— und Sonderklassenschulern," (Committee for the investigation of the ability of children. Comparative study of the ability of pupils in classes for normal pupils and classes for sub-normal children.) *Padagogisch-Psychologische Arbeiten aus dem Institut des Leipziger Lehrervereins*, XVIII (1930), pp. 7-48.

The performance of sub-normal children is poor in all subjects, sub-normal children attaining about 74 percent of performance of normal children. (E. P. Appelt, University of Wisconsin.)

WITTY, PAUL A., AND LEHMAN, HARVEY C. "A Study of Vocational Attitude and Intelligence," *The Elementary School Journal*, XXXI (June, 1931), pp. 735-746.

From an analysis of the results secured from the Lehman Vocational Attitude Quiz and the National Intelligence Tests, Scale A and B, given to the pupils of six elementary schools in Kansas City, Missouri, the authors conclude that the dull boys reveal immature attitudes, choosing a larger number of occupations somewhat indiscriminately.

NEW TESTS

ALLEN, RICHARD D., BUTTERFIELD, WALTER H., AND TULLY, MARGUERITE. *Providence Inventory Test in Music*, (Form A), Yonker-on-Hudson, New York: World Book Company, 1932.

A test, for grades 4 to 9, to measure individual differences in musical knowledge and skill to be employed in the discovery of individual differences.

BLACKSTONE, E. G., AND MCLAUGHLIN, MARY W. *Blackstone Stenographic Proficiency Tests* (Forms A and B). Yonkers-on-Hudson, New York: World Book Company, 1932.

A test to measure several essential abilities, consisting of: English, syllabification, office practice, alphabetizing, abbreviations, business organization, and transcription.

RESEARCH NEWS and COMMUNICATIONS

Address all research news and communications to Editor Carter V. Good, Teachers College, University of Cincinnati, Cincinnati, Ohio.

Results of the Social Studies Investigation.—The Investigation of the Social studies in the Schools, sponsored by the American Historical Association, will publish its results in a number of separate volumes through the press of Charles Scribner's Sons. The first part of the report, entitled *A Charter for the Social Studies in the Schools*, drafted by Charles A. Beard, and the second volume, entitled *Some Chapters from the History of the Teaching of the Social Studies*, by Henry Johnson, are available. The third volume, by Bessie L. Pierce, is entitled *Citizens' Organizations and the Civic Training of Youth*, and was expected from the press during the summer.

Meanwhile, work on the testing program is being rounded out by Truman L. Kelley, and the investigation of the geographical element by Isaiah Bowman in a volume entitled *The Service of Geography to the Social Studies* is being completed. These two studies should be ready for the press by fall. Ernest Horn and R. M. Tryon are devoting the major portion of their time at present to completing the work on methods and organization of content respectively. These studies will be ready some time next year. A more direct application of objectives to the problems of society is being prepared by Charles A. Beard and George S. Counts. This will be ready for the press some time toward the end of this year. Other studies of various aspects of the problem have been arranged for, and the final report of conclusions will be published in December, 1933.

The tentative titles of the various reports of the Commission, arranged in the probable order of publication, and the authors are as follows:

A Charter for the Social Sciences in the Schools, Charles A. Beard, formerly at Columbia University.

Some Chapters from the History of the Teaching of the Social Studies, Henry Johnson, Columbia University.

Citizens' Organizations and the Civic Training of Youth, Bessie Louise Pierce, University of Chicago.

The Pupil's Approach to the Understanding of Society, Truman L. Kelley, Harvard University, and A. C. Krey, University of Minnesota.

Services of Geography to the Social Sciences, Isaiah Bowman, American Geographic Society of New York.

Education in an Industrial Age, George S. Counts, Columbia University, and Charles A. Beard.

Organization of Content in the Social Science Programs, Rolla M. Tryon, University of Chicago.

Methods of Instruction in the Social Sciences, Ernest Horn, University of Iowa.

Civic Training in the United States, Charles E. Merriam, University of Chicago.

School Administration and Social Science Teaching, Jesse H. Newlon, Columbia University.

The Selection and Training of the Teacher, William C. Bagley, Columbia University, and Guy Stanton Ford, University of Minnesota.

Freedom of Teaching in the Schools, Howard K. Beale, formerly at Bowdoin College.

Social Ideas of American Educators, Merle Curti, Smith College.

Recommendations of the Commission; the publication of this, the final volume in the series, is planned for December, 1933.

Findings of the Survey of Secondary Education.—One hundred and fifty educational leaders and friends heard the report of L. V. Koos at a dinner in Washington, D. C. (on June 9) marking the completion of the three-year nation-wide study of high schools. Among those present were members of Congress, representatives of twenty or more educational organizations, and officers of the National Education Association, which sponsored the banquet, and of the Federal Office of Education. Significant findings of the survey are concerned with enrollment, curriculum revision, unit assignments, administrative reorganization, and library service. The study is based on returns from more than 200,000 inquiry forms answered by teachers, pupils, parents, and employers, and from visits to more than 550 different high schools in practically every state.

The present proportion of enrollment in American high schools has never been equalled at any other period or in any other country, which indicates that rapidly increasing numbers of children from the lower economic levels are being given the opportunities of education at the secondary level. Enrollment increases have been from 4 percent of boys and girls of high school age in 1890 to approximately 50 percent to-day.

Certain projects of the survey reveal widespread tendencies toward change in the curriculum of the schools. One study shows an increase in the number of different courses offered in the same group of schools for two periods about twenty years apart of from 53 to 306. The dominant shifts in subjects required of all pupils have been away from foreign language and mathematics (college entrance required subjects) toward social subjects and physical education. One classified high school in the East recorded a decline in foreign language and mathematics from 95.6 percent of all work taken in 1890 to 58.6 percent in 1930. For a high school in the West, the proportion in the same subjects declined over a similar period from 54.5 percent to 32.7 percent. Nonacademic subjects including the fine arts, practical arts, and physical education have shown an increase. In many schools nonacademic subjects now claim from a third to two-fifths of all the pupil's time in the classroom.

Procedures characterized by the unit assignment are among the most frequent provisions for individual differences. Many practices in use under different classifications such as the Dalton, Winnetka, Morrison, and other plans are said to deviate widely from those characteristics of plans described by their originators, while many others are essentially identical in form. A significant implication in this connection is that terminology is needlessly elaborate and complex, and that the educational world will be better off if it discards a great deal of this jargon.

Size for size, up to enrollments of about 1,600, the six-year school has advantages over the separate three-year junior and senior high schools. Size of enrollment is a more important factor of difference between schools than type of organization. The vitality of the junior college movement seems to demand that

this new unit be given a prominent place in the school system.

Information from 400 schools and findings of a specialist who traveled more than 13,000 miles to study facts first hand reveal that the high school library will soon become one of the central features of the modern secondary school. Reports were furnished also for this study by 17,000 pupils, revealing that the proportion of pupils making some use of the library in schools operating a combined plan of library and study hall is more than twice as large as in schools in which the two are separate.

Among other significant findings are: an increasing number of trade schools, fewer technical and commercial high schools, development of continuation, evening and summer schools, use of correspondence courses, flexibility in requirements for admission to colleges and universities, and increasing opportunity for Negro secondary education in the Southern States.

It is essential for school officers in one state to know the nature and direction of progress in the schools of other states. Such information is provided in the survey findings, to be incorporated in twenty-eight different monographs, which it is said would have taken one man from fifty to sixty years to gather if he had been working alone. Several of these volumes will be available this fall.

State School Finance Committees Named.—Committees composed of leading citizens in each state have been named to work with the National Survey of School Finance. These committees were nominated by state superintendents and commissioners of education, and include state legislators and officers, school officers, university professors, and other prominent citizens. Problems of financing the schools have brought demands for information which will throw light on special questions confronting each state. For this reason, it has been deemed advisable by the survey's board of consultants and authorities in finance, education, and research to invite participation by state "contact" groups. Leaders selected in each state will be informed of the progress and advance findings of the nation-wide school-expenditure study, and will be asked for advice from time to time by the survey research staff. Each state committee will meet with U. S. Commissioner of Education Cooper, director of the survey, or Paul R. Mort, associate director. Federal funds for this survey were provided until last July 1. Funds from private auspices will support continuation of the work. It is expected that study of the major project of state aid to schools will be far enough advanced to permit state committees to work with state legislatures next session. Names of committeemen appointed may be secured from the U. S. Office of Education, Washington, D. C.

Yearbooks of Departments of the N. E. A.—Yearbooks are tentatively planned as follows:

Department of Elementary School Principals—The Elementary School Principal and the Libraries, 1933.

Department of Superintendence—Educational Leadership, 1933, and School Administration, 1934.

Department of Classroom Teachers—Character Education, 1932, and The Teacher and the Public Relations of the School, 1933.

Activities Curriculum Yearbook.—The original committee in charge of this yearbook of the National Society for the Study of Education was under the chairmanship of Frederick G. Bonser who died

June 8, 1931. Under his leadership the committee had but one meeting, which was at the beginning of his prolonged illness. The new chairman, Lois Coffey Mossman, was appointed the following December and has presided over only one meeting of the yearbook committee. Death has taken another member of the original committee, E. M. Sipple, who was director of the Park School in Baltimore, Maryland. The committee at present consists of the following people: William S. Gray, University of Chicago; Ernest Horn, University of Iowa; Superintendent E. E. Oberholtzer, Houston, Texas; Assistant Superintendent of Schools Mildred English, Raleigh, North Carolina; Adelaide Ayer, Milwaukee State Teachers College; William H. Kilpatrick, Teachers College; and Lois Coffey Mossman, chairman, Teachers College.

Five Years After the Pharmacy Study.—A mimeographed bulletin of seventeen pages prepared by W. W. Charters of Ohio State University, director of the Pharmacy Study of 1923-26, is an evaluation of the use made of the report, *Basic Materials for a Pharmaceutical Curriculum*, during the past five years. The replies from fifty-three colleges of pharmacy indicate satisfaction with the use made of the study since the report was published. The investigation in question has received widespread attention in educational circles as a painstaking example of the technique of job or activity analysis in curriculum making.

Research Division, N. E. A.—Publications of the Research Division of the National Education Association which have appeared between January 1, 1932, and September 1, 1932, include the following studies:

1. "Administrative Practices Affecting Classroom Teachers: Parts 1 and 2," *Research Bulletin*, Vol. 10, Nos. 1 and 2, January and March, 1932. Part I deals with the selection and appointment of teachers. Part II considers their retention, promotion, and improvement.

2. "Estimating State School Efficiency," *Research Bulletin*, Vol. 10, No. 3, May, 1932. This bulletin summarizes past studies and presents comparative data with respect to the present standing of the states on five important factors.

3. "State School Legislation, 1931," *Studies in State Educational Administration*, No. 10, February, 1932. This publication is a summary of the major aspects of 1931 school legislation.

4. "The Corporation Income Tax and Its Relation to School Revenue Systems," *Studies in State Educational Administration*, No. 11, September, 1932. This is the third of a series of studies of current practices in state taxation.

5. *Teachers Professional Organizations* is a syllabus for college classes or other study groups, containing a teaching outline, problems for further study, and sources of information.

The Research Division has coöperated in an editorial and consultative capacity with regard to the publications of certain departments of the National Education Association:

1. The *Tenth Yearbook* of the Department of Superintendence entitled "Character Education" was issued in February during the Washington meeting of the Department. It is a discussion of character education as a function of the school.

2. The *Eleventh Yearbook* of the Department of Elementary School Principals has as its subject "The Principal and His Community." It is a survey of school-community contacts and emphasizes the principal's opportunity for local community leadership.

3. The *Seventh Yearbook* of the Department of Classroom Teachers was issued in June with the title "The Classroom Teacher and Character Education." It contains abundant illustrations of actual classroom activities contributing to the development of character.

4. "Special Methods on High-School Level" is the subject of the February issue of the *Review of Educational Research*. This is the first number of the second volume of the *Review* which is published by the American Educational Research Association, a department of the National Education Association.

5. "Finance and Business Administration" is the subject of the April issue of the *Review of Educational Research*.

6. "Tests of Personality and Character" is the subject of the June issue of the *Review of Educational Research*.

The Educational Research Service, maintained in coöperation with the Department of Superintendence, has issued these circulars since January 1, 1932:

1. "City School Expenditures, 1930-31," Circular No. 1, January, 1932. This study summarizes the returns from a questionnaire sent on November 13, 1931, to which 348 cities replied.

2. "Education Discussed in Lay Magazines, April 1, 1932," Circular No. 3, April, 1932. This summary covers the period from February 1 to April 1, 1932.

3. "Education Discussed in Lay Magazines, February 1, 1932," Circular No. 2, February, 1932. This summary of articles relating to education which have appeared in non-educational magazines covers the period from December 1, 1931, to February 1, 1932.

4. "Local Practice in Selection of Teachers in 274 City School Systems," Circular No. 4, April, 1932. This circular contains a city-by-city tabulation of certain practices in the selection of teachers.

5. "Some Trends in City School Finance, 1932-33," Circular No. 5, May, 1932. This study tabulates the replies from 1401 city school systems to a questionnaire dealing with budgets and proposed economies.

6. "School and City Current Expenses Compared, 1930; 310 Cities above 30,000 in Population," Circular No. 6, May, 1932. This tabulation of total city expense and school expense is based on financial statistics collected by the United States Bureau of the Census.

7. "Education Discussed in Lay Magazines, June 1, 1932," Circular No. 7, 1932. This summary of articles in non-educational magazines covers the period from April 1 to June 1, 1932.

8. "School Funds on Deposit: Protections and Interest Rates," Circular No. 8, June, 1932. This circular outlines the methods of protecting school funds in 38 large cities.

Tennessee Division of Research.—A Division of Research and Statistics was established in the Tennessee State Department of Education on January 1, 1932. Its support was made possible by a grant from the General Education Board of New York City. The personnel of the new Division is composed of Eugene L. Pearson, director, and Mrs. Louise King Griffith, assistant. Mr. Pearson was formerly a statistician in the United States Office of Education at Washington. One of the major functions of the new Division is to compile the data for the annual statistical report which is published by the state department of education. In connection with this phase of the work, the assistance of school executives will be invited in order to develop a better means of pupil and cost accounting.

George Peabody College for Teachers has made available its library to the members of the Division, which will be a valuable aid. As soon as the Division has more adequate data and facilities, it is planned, with the coöperation of graduate students in residence at Peabody, to make certain studies which will assist them in fullfilling their thesis requirements and at the same time be of benefit to the state department of education. The first survey will be concerned with the teacher-training institutions of the state. The next study will deal with the financial condition of the county public schools.

Intelligence Testing in Scotland.—During the week of June 5, 1932, a testing investigation was carried out in the Scottish schools by the Scottish Council for Research in Education. The survey consisted of an intelligence test applied to children of eleven years of age only (those born in 1921). It is intended to throw light on variation in maturity of intelligence, apart from age, and the differences in capacity of children to benefit by the type of education which they are receiving. The survey involves 90,000 children throughout Scotland, and only ten small private schools are not participating.

Some of the results secured from the test results include the proportion of: mentally defective children in Scotland, children capable of benefiting from secondary school education, and children capable of benefiting from university education.

The cost of the investigation will amount to 500 pounds. Since Scottish children have not been accustomed to taking intelligence tests, a preliminary examination consisting of eight questions was given. The actual test consisted of seventy-one questions for which forty-five minutes were allowed.

Coöperative Test Service.—The purpose of the Coöperative Test Service, 437 W. 59th Street, New York City, under the terms of the subvention from the General Education Board and under the auspices of the American Council on Education, is to construct ten or more comparable forms of examinations in the fundamental subjects of junior college and senior high school levels, and to make them available to the colleges and schools, one form each year, at the lowest possible cost. Colleges and schools may inaugurate the use of these tests with the assurance that a new comparable form of each will be made available each year about April 15. The advantages of tests with a large number of forms, in terms of uniform standards from year to year and for comparative purposes, are obvious.

Report of the Carnegie Foundation.—The twenty-sixth annual report of the Carnegie Foundation for the Advancement of Teaching covers the year ending June 30, 1931. The president of the Foundation is Henry Suzzallo. In the past nineteen years the Foundation has expended more than $1,098,000 in studies relating to colleges and universities. Its resources are $31,824,500. During the past twenty-six years it has expended upon retiring allowances and pensions for college and university professors more than $21,000,000. The report comments upon the Pennsylvania study of relations between high schools and colleges, legal education, and reorganization of college athletics.

General Education Board Projects.—The annual report of the General Educa-

tion Board for 1930-1931 includes an account of the following projects and subsidies of especial interest to workers in the field of educational research: a study of articulation between secondary schools and colleges at the University of Buffalo, $60,000; experimental use of an independent study plan extended to the junior college at Stanford University, $20,000; the new University of Chicago plan of divisional reorganization, $371,700; the University of Chicago survey, $50,000; changes in connection with honors work at Mt. Holyoke College, involving enlargement and reconstruction of the library, a conditional appropriation of $375,000; Carleton College, a conditional grant of $1,500,000; a study of the comprehensive examination by the Association of American Colleges, $25,000; a study of standards by the North Central Association, $110,000; a new edition of a Handbook of American Universities and Colleges by the American Council on Education, $7500; an investigation of methods of cataloguing unusual library items by the American Library Association, $13,500; support of divisions of information and statistics in Alabama, Arkansas, North Carolina, and West Virginia, and divisions of schoolhouse planning and construction in Oklahoma and Texas, a total of $69,800; a new division of school libraries in Alabama, $30,000, and of information and statistics in New Mexico, $27,000; and special curriculum and administration studies in Florida, Virginia, and Oklahoma, a total of $24,300. In addition to these studies and projects the Board gave generous aid to holders of fellowships, training of librarians in the South, and to Negro education. In many instances the grants are distributed over a period of years.

Studies Under Way in Higher Education.—A mimeographed bulletin of the United States Office of Education under date of March, 1932, is a partial list of investigations in progress dealing with student personnel, collegiate instruction and curriculums, improvement of methods of testing, and administration.

Curriculum Bibliography. — Mimeographed bulletin No. 5, 1932, of the Society for Curriculum Study includes 352 references covering the period from March, 1931, to March, 1932. The compilers are Henry Harap of Western Reserve and Edgar Dale of Ohio State.

New Journal on Personality.—Duke University Press, Durham, North Carolina, announces publication of a new journal, *Personality:* A Quarterly for Psychodiagnostic and Allied Studies, with the first number in September, 1932. The editor is Robert Saudek of London with an international collaborative staff. The subscription price is $3.50 per year. Fields of interest of the new journal will be: the investigation of characterology, typology, the bio-physical basis of personality, experimental graphology, differential and social psychology, psychiatry, psychoanalysis, family study, the study of heredity and of glands, experimental behaviorism, criminology, anthropology, and comparative animal psychology.

Yearbook on Negro Education.—The new *Journal of Negro Education*, published by Howard University and edited by C. H. Thompson of the same institution, has devoted its second (July) number to *A Critical Survey of the Negro Elementary School.* The topics treated are: financial support, administration

and control, physical equipment, teaching staff, supervision, student personnel, curriculum, the handicapped child, and bibliography.

Penn State Graduate Abstracts.—The second volume of abstracts of theses in education at Pennsylvania State College includes summaries of thirty-two Masters' and Doctors' studies. Each abstract is two pages in length, which permits cutting the book into cards, classification by topics, and filing in the *Loyola Digest*.

Curriculum Revision at Stoneham, Mass.—The plan initiated by Supt. C. E. Varney is rather unique and comparatively inexpensive. With his elementary supervisor, a grade principal, the assistant high school principal, and five teachers, he entered a class in arithmetic reconstruction under G. M. Wilson at Boston University. Weekly conferences of all grade teachers were arranged. A local survey of arithmetic usage by adults was begun. Soon committees of teachers were working on several problems basic to the arithmetic curriculum. The principle of 100 percent results in tool processes was accepted, and final success seems already assured. Other principles are being set up, such as "meaning" first in verbal problem work, elimination of socially useless processes, etc. The work no doubt will continue in intensive form throughout another year. The efforts for better results in arithmetic are affecting favorably work in other subjects.

Cubberley National Committee.—Dr. Ellwood P. Cubberley, Dean of the School of Education of Stanford University, reached the compulsory age limit and retired from active service at Stanford on June 6, 1933. A representative national committee is making plans for a suitable commemoration of his thirty-five years of outstanding service to American education as administrator, teacher, author, editor, and educational statesman.

Research in Silent and Sound Pictures.—A committee of experts appointed by the Commissioner of Education gave to eighth-grade boys and girls from the various states a preliminary examination at Washington, D. C., to ascertain their knowledge of a given group of subjects. On the three days following, educational sound pictures, prepared by the Fox Film Corporation, covering the same group of subjects were shown the children. Finally, they were given another set of examinations to determine how much they had learned from the pictures seen and heard. The subjects covered were volcanoes, glaciers, rivers, toads, and Monarch butterflies. The report shows that the boys and girls answered correctly, on an average, nineteen more questions out of fifty on each test after seeing the sound educational pictures than they did before. This is an average gain of 38 percent. An earlier comparable test, involving silent film and conducted by David C. Knowlton in 1928, showed an average gain of 19 percent. Therefore, a comparison of the two tests seems to indicate that sound pictures are twice as effective in terms of gain as silent ones in educational work.

During the past two years or more the Electrical Research Products, Inc., New York City, also has sponsored a program of investigation in connection with the production of educational sound pictures. A survey of the literature in the field of visual education indicated that the effective use of many silent films in the schoolroom is affected by the following limitations: (1) the pictures do not readily fit into or correlate with the cur-

ulum because teacher-pupil needs and urse of study requirements were not nsidered in the preparation of materials r the picture; (2) the pictures often plicate the teacher's efforts and present aterials which the teacher could obtain other ways; (3) many of the films ve little or no educational value; and 4) the costs of equipment and pictures e often prohibitive.

In an effort to overcome the deficiencies the silent films, a tentative set of standards was set up to guide the production of educational talking pictures. These are that: (1) no sound should be recorded which does not aid the pupil in interpreting the picture before him; (2) no action should be shown which does not have a significant meaning to the pupil; (3) each scene should be as pictorially perfect as possible and include all of the elements associated with such material in a life situation; (4) the picture materials should be definitely arranged for different levels of instruction; (5) the picture should possess unity, each scene being an integral part of the picture as a whole; (6) the picture must correlate with the learning experiences being created by the school; (7) no materials should be presented in the picture which the teacher might otherwise obtain; (8) the materials should be checked with authoritative sources to determine their accuracy; and (9) to be a real contribution, pictures must arouse and hold the interest of the pupil and act as a stimulus for further activity.

Circular No. 46, January, 1932, of the United States Office of Education, prepared by J. O. Malott, presents in some detail the status of motion pictures in public elementary and secondary schools. While the data secured are incomplete, selected items may be summarized. Four thousand of the principals and superintendents in communities of 2,500 or more reported some use of films. Of 301 communities 37 percent have visual-education departments, while 36 percent secure their pictures through the efforts of individual teachers in connection with their instructional projects. Of 439 school systems 49 percent finance their motion pictures through the board of education, and 17 percent through revenues from entertainment and school funds. In 13 percent of the communities "free" films were used exclusively. Nearly one-half of the systems did not secure any of their films from commercial sources. Two-thirds secured more than one-half of their films from educational centers (city, state, federal, and university). Other sections of the report deal with the length of time the borrowed films are retained (usually one day), uses of motion pictures (most common in social sciences, natural sciences, and physical education), objectives achieved, difficulties, and use of teaching aids.

TESTS THAT AID PUPILS TO LEARN HOW TO LEARN

Since the time when the Persians defined an education as the ability to ride a horse, to shoot straight, and to tell the truth, learning has begun with some experience of a situation in which a need to improve performance was evident. Such an experience indicates at once the point where learning must begin.

This critical point, where failure would begin if learning did not, becomes a personal experience of each pupil and calls out an actual incentive to learn. Instruction, when it starts at this point, leads easily to self-directed study. This is not accomplished when a temporary and extraneous interest takes the place of an actual personal experience of the purpose to learn in order to complete that personal experience.

The instructional tests and the program for their use in the schools this year, outlined on the next page, provides the way for instruction to hit the mark from which to start a study experience.

Percent Pupils Score is of Perfect	TEST NUMBER		
	III	IV	V
100			
95-99			6
90-94			6
85-89			4
80-84			
75-79			6
70-74			5
65-69			4
60-64		2	2
55-59		5	1
50-54		6	
45-49		9	1
40-44	3	5	
35-39	7	5	
30-34	8	2	
25-29	12	1	
20-24	2		
15-19	1		
10-14	1		
5-9	1		
0-4			
Total No. of Pupils Tested	35	35	35
Median Percent Correct	30.3	47.5	78.8

More than this, these tests call out the incentives of the pupils for study. Each one tends at once to advance his present experience so as to include that which is to be learned.

The following illustrates the type of study situation set up by the Sangren-Reidy Tests in Arithmetic. When the study of decimal fractions is taken up and the idea is presented that the decimal point indicates the fractional part of the number, and the number of decimal places (as a power of ten—tenths, hundredths,) indicates the denominator of the fraction, then give the first test for this topic. The difficulties of the idea of decimal fractions for some pupils will be found as each comes to a test exercise in which the use of the decimal process is not clear to him. For instance, a pupil divides .15 by 3 and gets the answer, .05. But in the next problem he does not understand how, in the process of dividing 24.6 by 4, to handle the remainder of two-fourths of a tenth by changing the quotient 6.1$\frac{2}{4}$ to 6.15. This change he is able to work for himself when he recalls that .6 is also .60 and that a quarter of 60 hundredths is .15.

The class record sheet for three increasingly difficult tests on the use of decimal fractions is given at the left. The first test includes 15 types of difficulty. The second 18 more difficult types and the third covers the most difficult work. Note that by discovering where each pupil reached his limit on the first test and by holding all pupils to the incentive to learn why and how, all advance their attainment by nearly equal amounts. A similar advance was made by all on the final test. Note that the lowest pupil made a higher score on the third and most difficult test than the best pupil had made on the first test. Every pupil learned how to learn.

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